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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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The Foundry Exhibition

The Foundry Trades' Equipment and Supplies Association decided that this year the widest interests of the foundry industry would be better served by joining forces with the well-established Shipping, Engineering and Machinery Exhibition. They did so because of the superior location of Olympia, and its wider appeal to the general public, and because the combination makes the exhibition much more of a true foundry exhibition, as on previous occasions the exhibits were mainly confined to equipment and raw materials. The exhibition, which opens to-day, includes amongst exhibitors about fifty foundries, and as many of them work for the marine and heavy industries, the examples of the products from their shops are necessarily of a high-grade character. There are about forty exhibits in the foundry section, but many of the stands in the engineering section are of equal interest. For instance, those interested in the application of nickel to the manufacture of castings, electric melting and heat-treating furnaces, iron cements, welding, small fettling tools, cupola blowers, patternmaking machinery and testing machines must tour the engineering section. There are definitely novel exhibits, by which we imply that they have never been shown before at a foundry exhibition, in the following sections:—Moulding machines; cleaning of castings by streams of chilled-iron grit thrown by centrifugal force and so eliminating compressed-air lines; metal spraying; numerous new examples of small tools for the fettling shop; core-blowing machines; a corebox vice; testing machines; an electric melting plant showing outstanding control features; low-temperature electric heat-treatment furnaces; a high-duty cast iron; crucible furnaces; chilled-iron grit; laboratory apparatus, and patternmaking machine tools. It is clear that a visit to Olympia is essential for every foundry executive, both British and foreign. Whilst we have indicated the novelties, it should be borne in mind that there is a wealth of knowledge to be had for the asking on the stands of the pig-iron and coke manufacturers and those organised by the development departments of the soda-ash and nickel interests. In addition, the non-commercial exhibits of the Institute of British Foundrymen and the British Cast Iron Research Association are invariably of an extremely helpful character and are, as usual, to be staffed by experts. THE FOUNDRY TRADE JOURNAL stand no longer takes the form of a sylvan cottage, but is now a building of modern and distinctive design. Here we shall be pleased to meet old friends and form new contacts. Mr. Lennox Holt, our advertising director, is to be in charge.

Finally, we wish to make a special plea to foundry owners and directors to send as many as possible of their staff, both executive and working, to Olympia during the next fortnight. They will return to their shops with a better appreciation of what is available to aid them to achieve higher production of an enhanced quality.

The British Foundry School to Open

We understand that the governing body of the British Foundry School has definitely decided, after discussion with the Board of Education, to open the School in October, and we think that all those who have been concerned with this development are to be congratulated on the success of their efforts. A very great deal of work has been involved in the preliminary organisation, and, of course, much more will be required before it is in smooth running order. Of its kind, the School is unique, and as time goes on it will doubtless shape itself fully to meet the needs of the industry. It seems to us to have one supreme advantage. In the ordinary way of education, the young people going through the mill have to take largely on trust what their seniors and teachers think is good for them. As the imagination of the student fails to tell him, since he has no experience, an elaborate educational discipline is required to enforce this. Now where the interest of the student is aroused, this discipline is not required, and the interest comes when he goes to school knowing what he wants to learn. He gets this from a little practical experience as a preliminary. The Foundry School seems to have the advantage of only taking students connected with the industry (and hence whose subsequent absorption presents no problem) and who have had practical experience in it. They know their deficiencies and what the industry calls for. Thus they will be eager to learn.

This point was illustrated very forcibly by Dr. A. D. Lindsay, of Oxford, in relating an experience by a Workers' Educational Association

(*Concluded on page* 178.)

Book Review

The Book of Stainless Steels. Edited by Ernest E. Thum. Published by The American Society for Metals, Cleveland, Ohio. Price $5.00.

The first edition of this book was published in 1933. The present edition contains some 150 more pages than the original, and includes recent developments in stainless steels. The general arrangement is similar to that of the first edition, the book being divided into six parts:—Part I, General Considerations; Part II, Production and Fabrication; Part III, Properties of Typical Alloys; Part IV, Specialised Tests; Part V, Requirements of the Consuming Industry; Part VI, Indices.

Each different part is sub-divided into a number of sections dealing with special aspects of stainless steels, each chapter being written by a specialist in that particular branch of the trade.

New chapters dealing with castings in 5 per cent. chromium steel and 18 per cent. chromium steel have been added. The chapters dealing with general foundry practice for stainless steels have also been considerably enlarged. In addition a new section has been added dealing with the use of stainless steel for railway rolling stock. The book not only covers what are normally considered to be stainless steels but also touches on such materials as "Stellite" and "Illium."

The editor has done his work well in gathering together such a mass of material into a very readable book. A large amount of information on the behaviour of stainless steels in different chemicals is given, but some of the tables do not state clearly the concentrations of the salts referred to. On page 602 for instance, it is stated that alkalis cause caustic embrittlement of cast iron. There is no reference that supports this statement, and we think that this should be checked before the next edition is published.

Some of the authors have included excellent lists of references at the end of their sections, and we think that this feature could well be included throughout. At the end of the book is an index which classifies the trade names of American steels. An extension of this to cover some of the better-known English and Continental steels would have been of great assistance to readers on this side of the Atlantic. The diagrams, illustrations and photomicrographs are well reproduced, some of the latter being remarkably sharp and clear. Essentially this is a book of reference. It contains a wide miscellany of data on stainless steels and should find a place on the shelves of both manufacturers and users of such materials. E.W.C.

The British Foundry School to Open

(*Concluded from page* 177.)

in the Midlands. In classes attended by workmen after their day's work over a period of years, a high standard was attained. They learned because of their experience in everyday life, while students, he said, who lived a protected and artificial existence in schools and colleges had to learn the answers to questions, the import of which they did not fully appreciate owing to their lack of practical experience. In similar classes attended by unemployed men with plenty of time to study, the results were negligible, and in no way to be compared with the high standard attained by workmen in full employment. He thought that the unemployed lost status in their own estimation, and with it lost interest. While these classes were not vocational, the parallel is useful and the point would be still more obvious in vocational studies.

Some Interesting Aids to Production

Considerable developments are announced by Robson Refractories, Limited, of 47, Coniscliffe Road, Darlington. They have been appointed sole selling agents for Berco parting powder, which is manufactured by the Eaglecliffe Chemical Company. Amongst the claims made for it is a negative one, but of real importance, that is that it contains no free silica, and so the question of silicosis does not arise. Positive claims are in regard to its being waterproof and exceedingly finely ground, which latter factor makes for economy.

A second development is the sale of the Quick-Gag machine for the rapid making of gaggers. Its production is of the order of 250 to 300 per hr. when using $\frac{3}{8}$-in., $\frac{1}{2}$-in. or $\frac{5}{8}$-in. bars. The machine is cleverly conceived and the mere pulling of a lever causes an attached roller running in a confined circular pathway to bear upon the rod and give to it the necessary angle; this movement also causes a cutter to act and a rod threaded through a hole near the base of the machine can be sheared off to length.

It is interesting to note that the Speedy moisture tester, a purely British device, is receiving universal approbation and deliveries have recently been made to Japan, Poland, Czecho-Slovakia, the United States of America and France.

Effect of Vibration

The "Technical News Bulletin" of the U.S. National Bureau of Standards states that in the published accounts of a recent endurance flight of an aeroplane, widespread publicity was given to the belief that metals may fail as a result of crystallisation caused by vibration in service. This erroneous belief probably originated in an incorrect conclusion drawn from the typical appearance of the fractured surfaces of metals that failed after having been subjected to repeated cycles of service stresses. It has been known for a long time that all metals in the solid state are aggregates of crystalline grains, generally of microscopic size. It is also known that the original crystalline structure cannot be altered by purely-mechanical forces which do not permanently alter the outward form of the metal piece.

When a metal breaks from a single application of a force, the fracture takes place along natural cleavage planes through the crystal grains and the fracture exhibits a characteristic crystalline appearance. In ductile metals, fracture does not take place until considerable deformation has occurred.

However, when metals are subjected to repeated applications of force, fracture can occur without deformation, even in the most ductile metals, if the range or amplitude of the force exceeds a limiting value. For steels this value is generally about 50 per cent. of its strength under steady loads, but may be as low as 20 per cent. or as high as 60 per cent. This value is known as the endurance or "fatigue" limit. The fracture originates at a point where the stress is the maximum, or in some localised weakness. The crack itself, once started, is a localised weakness and grows with repeated-stress application, generally perpendicularly to the direction of the applied forces. As the advancing crack cuts off more and more of the sound metal, the load is carried by a progressively decreasing area, and finally sudden and complete rupture of the members occurs. The combination of the sudden break with the formation of a fracture which one is accustomed to find in very brittle materials is naturally disconcerting.

Metal Marketing Changes

(FROM A CORRESPONDENT).

Customs change in business as in everything else and what were commonplace methods a decade ago are quite out of date to-day, while who knows but what our present ideas may perforce give place in due course to an alteration which will compel a complete revision of existing plans. These changes may be brought about in many different ways, and those who were familiar with commercial customs prior to the war know that the upheaval caused by four years of conflict has resulted in root and branch alterations calculated to make experience gained a quarter of a century ago of little avail to-day. To keep up to date is essential if a business house is to survive and in order to do this method must match the movement of events.

In the non-ferrous metals much has happened to make changes since 1918, and all concerned have been hard put to it to keep abreast of events, while very few have been clever enough to foresee important alterations calculated to compel on many occasions a complete *volte face*. Perhaps the most noteworthy change has been the tendency towards direct marketing, *i.e.*, the elimination of the merchant in favour of a system under which the producer makes direct contact with the consumer through the medium of his own sales organisation, or alternatively allows a middleman a commission on all metal passing into consumption. In earlier years it was customary for merchants to make purchases on their own account from the producers and to pass this metal on to the manufacturers as and when they required it, the market risk involved in holding very considerable tonnages, often over long periods, being shouldered by the factors.

We know that the recent enquiry of the I.D.A. Committee into the lead and spelter situation revealed the fact that the volume of business on the London warrant market had dwindled very considerably, the explanation given being that consumers discontinued buying on the metal exchange when they found that it was almost certain foreign, and therefore dutiable metal, would be delivered to them in exchange for their warrants. Actually a change had come about before the import duty on lead and spelter was levied, for it was becoming customary for producers of these metals to market their output on a commission basis, this method entailing no risk of depreciation in their holding to those houses handling the business. Hence hedging transactions on the metal exchange dwindled in volume, and even though the revision of the duties may result in more business being handled in Whittington Avenue this is not likely to be on a really large scale so long as the old method of marketing through the merchant are not employed.

From the consumers' point of view there is much to recommend the changes which have occurred, for whereas under the earlier system there was every inducement to the big merchant houses to manœuvre for position by inducing price movements on the metal exchange, by means of which they were able to nett considerable profits, that temptation is now almost entirely removed. Quite apart however from this aspect of things there cannot be any doubt that in the long run a manufacturer scores by having direct contact with a producer's organisation, for relations are established which rarely obtain when metal is sold through factors. To put it bluntly there is always a chance that the third party has an axe to grind, and consumer and producer, the people most vitally interested in each other, do not have the chance to thrash out their problems. In many cases of course things have gone a stage further and mines have acquired consuming units as an outlet for their production.

THE INTERNATIONAL FOUNDRY EXHIBITION

This exhibition, held in conjunction with the Shipping, Engineering and Machinery Exhibition, is to be opened this morning by the Rt. Hon. The Lord Sempill, A.F.C., F.R.Ae.S. The description of the exhibits which occupies this and the following pages has been set out alphabetically, with headings indicative of the main line of machinery or materials exhibited. An asterisk indicates that such an exhibit is contained within the foundry section. A cordial invitation is extended to readers of the "Foundry Trade Journal" to visit our Stand No. 18 F (F) where, in addition to this Journal, its associated periodicals, "Iron & Coal Trades Review," "Sheet Metal Industries," "Metal Treatment," and "Ryland's Directory," will be available for inspection

REFINED IRON*

The range of special "New Process" pig-irons made by *Sir W. G. Armstrong, Whitworth & Company (Ironfounders), Limited*, Close Works, Gateshead-upon-Tyne, shows admirably the improvements that can be made in giving higher strengths, greater resistance to wear, and definitely homogeneous castings free from porosity and shrinkage. Fractures of various grades are shown, each suitable for certain purposes. Castings made from these irons are exhibited and vary from a locomotive cylinder weighing 1½ tons to light green-sand castings of a few pounds. From these castings it will be observed that "New Process" pig-iron is being used for work in all classes of industry, automobile, electrical, agricultural, etc., and is specially suitable for internal-combustion engines and high-duty castings.

The introduction of chilled-cast pigs is worthy of notice, and a stack of chilled-cast iron is laid alongside sand-cast iron so that foundrymen will be able to judge which is more suitable for their purpose. Alloy pig-iron containing nickel, chromium, copper, molybdenum, etc., shows the progress that has been made in meeting the requirements of the most scientifically-controlled foundries.

Exhibits directly machined from pigs show admirably the close grain and toughness of "New Process" pig-iron.

Visitors to the exhibition are recommended to obtain from the Armstrong Whitworth stand a copy of their new brochure, which gives interesting and useful information regarding overcoming the everyday troubles that are experienced in the manufacture of high-duty castings. The stand is also staffed by experienced metallurgists who welcome the opportunity of discussing foundry problems and giving suitable mixtures for any type of work.

The "Closeloy" alloy heat-treated roll exhibited illustrates a type which is being widely used for the rolling of medium and fairly heavy sections, including the roughing and finishing of rails, channels, joists and angles. Of high strength and showing great resistance to wear and firecracking, considerably increased tonnages per dressing are obtained without detriment to the finish on the product rolled. By slight modifications to analysis and heat-treatment, different grades of roll can be produced to meet the requirements of varying conditions.

ANTI-CORROSIVE PAINTS*

The exhibit of the *Atlas Preservative Company, Limited*, Erith, Kent, will be one of particular interest to those concerned with the economic upkeep of plant, buildings and equipment constructed of iron and steel.

Their display will consist of painted specimens, together with mechanical models designed to demonstrate the elasticity and durability of "Atlas Ruskilla" iron and steel paint.

One of these models is illustrated above. It consists of a machine into which is fitted an actual film of "Atlas Ruskilla" paint (stripped from a prepared metal plate). The paint-film is subjected to continual twisting, first to right and then to left. Some idea of the durability of this paint can be gauged from the fact that the film in our illustration had withstood more than 100,000 turns without disruption.

It is claimed for this material, that by reason of the special medium employed in its manufacture, it will stand up to conditions which would render ordinary paints too short-lived to be profitable. On application, it grips the metal tenaciously, forming a tough, elastic film, which resists stubbornly the attack of industrial fumes, steam, moisture and exposure to weather. These claims would seem to be borne out by the fact that "Atlas Ruskilla" is used extensively in the mercantile marine, engineering works and foundries. It is made in black, white, aluminium, and a range of attractive colours.

For nearly half-a-century this company has specialised in the production of anti-corrosive coverings, and readers are invited to submit their corrosion problems, when technical advice will be forthcoming, without charge.

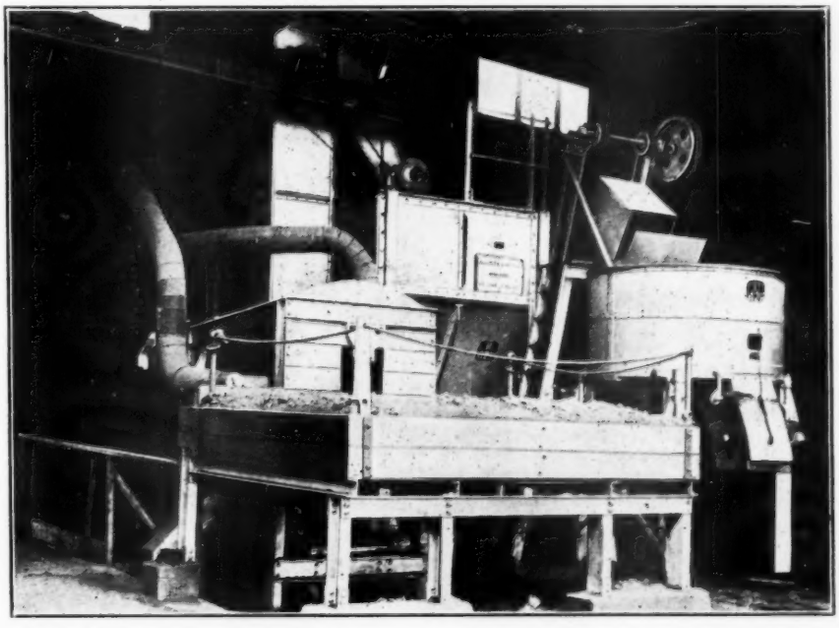
Some of the newer processes used by foundries evolve acid gases, and Mr. E. J. Penston and his colleagues on the stand, Messrs. A. J. Nicholson, S. C. Soward and C. A. Rowlingson, will be pleased to discuss this particular development.

EXHIBIT ON THE STAND OF THE ATLAS PRESERVATIVE COMPANY, SHOWING THE TORSIONAL TESTING OF A FILM OF RUSTKILLA PAINT.

SAND PLANT*

August's, Limited, Halifax, are exhibiting a No. 3 size (8-ft. dia.) August's Simpson sand mixer. This size of machine has a capacity up to 30 tons per hr. of moulding sand. They have installed hundreds of machines of this type, and the one exhibited represents all the latest developments and practice. Visitors will be able to examine this machine in detail and clearly see its design and construction. In addition, they are exhibiting a laboratory size of the same machine in operation.

They are also exhibiting large-scale photographs of August's composite sand plants, which embody the August's Simpson sand mixer as the sand-mixing unit. These plants are built by



A NO. 2 SIZE COMPOSITE SAND PLANT INSTALLED IN A STEEL FOUNDRY BY AUGUST'S, LIMITED.

them in sizes covering outputs of from 2 to 15 tons per hr. of iron-foundry facing sand, and are quite complete units for the reclamation of used foundry sand. In these plants the used foundry sand is cooled, oversize and foreign matter removed, iron and silt extracted, and this cooled, cleaned and iron-free sand is used as a basis from which to prepare, at will, any type of foundry-sand mixture that may be required.

These plants are universal in their application, can be used in any type of foundry, either iron, steel or non-ferrous, and can be used to prepare any type of facing sand, loam, core sand or merely to recondition backing sand. Together with this exhibit will be shown a number of samples of the foundry sand at various stages of the process, giving a very clear idea of the operation and principle of the plant. The plant illustrated is actually in use in a British steel foundry. It is a view of a No. 2 size August's composite sand plant, with a capacity on iron-foundry facing sand of 4 to 5 tons per hr., loam 2 tons per hr., and reconditioned or backing sand 8 to 10 tons per hr.

In addition, other large-scale photographs will illustrate August's mechanised core shops, showing latest developments in automatic sea-sand drying, screening, cooling, and core-sand-mixing plants, together with core-blowing machines and core-drying plants. With this particular exhibit will be shown samples of the core sand at various stages in the process, together with typical examples of large, heavy and intricate cores produced on the August's Borrmann core-blowing machine.

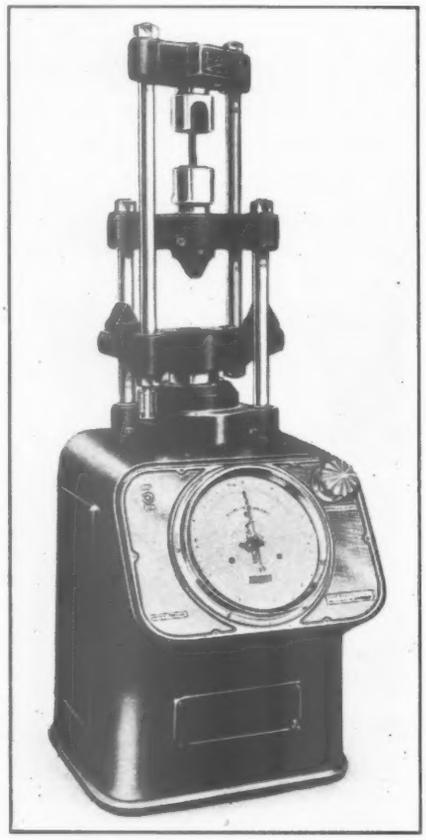
Large-scale photographs will show examples of August's large-capacity sand-reclaiming and preparing plants, conveying distribution systems, and mould conveyors, as well as special foundry plant for large core production. In addition the exhibits will include specially-prepared photographs of portable core- and mould-drying units, sand plants, core- and mould-drying installations, etc. This collection of exhibits will give a comprehensive list of examples of modern foundry mechanisation as carried out by August's.

TESTING MACHINES

An excellent range of testing machines of modern design is being exhibited and demonstrated on the stand of *W. & T. Avery, Limited*, Soho Foundry, Birmingham. They include *inter alia* a new transportable self-indicating Universal testing machine of 5 tons capacity (this machine is also made in a capacity of 10 tons); a larger self-indicating Universal testing machine of 50 tons capacity, representing the range of three models in which the machine is made, *i.e.*, 20 tons, 50 tons and 100 tons capacities; a direct-reading rapid hardness-testing machine for carrying out production tests; a Brinell-hardness testing machine; a fatigue-testing machine for Wohler specimens, and a self-indicating spring-testing machine for compression and tension tests on coil springs.

PIG-IRON AND COKE*

The firm of *William Baird & Company, Limited*, 168, West George Street, Glasgow, C.2, was established in 1829, and has a world-wide reputation for its well-known "Gartsherrie" and "Eglinton" brands of Scotch pig-irons, which are used extensively in the manufacture of all classes of castings. Special qualities to consumers' specifications are supplied to meet the requirements of the heavy engineering works, hydraulic engineers, agricultural and textile machinery makers, and the light-castings industry, etc. Advice in the selection of suitable irons from their various grades for special purposes will be readily given. This firm is a large producer of foundry coke having a very low sulphur and ash content, and is also a maker of a special coke with a maximum ash content of 1.5 per cent., which is used in the manufacture of electrodes. Specimens of their various grades of pig-iron and castings made therefrom, together with samples of foundry and special coke, are on view at their stand.



A NEW DESIGN OF TENSILE AND TRANSVERSE TESTING MACHINE BY W. & T. AVERY.

ELECTRIC MELTING FURNACES

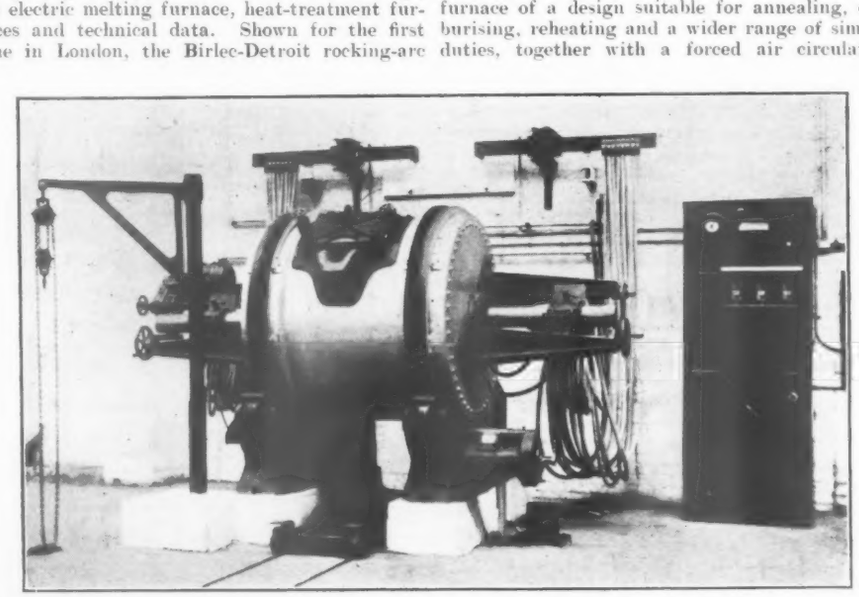
The exhibits of *Birmingham Electric Furnaces, Limited*, of Erdington, Birmingham, may be grouped, generally, under three main headings, the electric melting furnace, heat-treatment furnaces and technical data. Shown for the first time in London, the Birlec-Detroit rocking-arc melting furnace for ferrous and non-ferrous metals should attract very considerable interest. The furnace marks a noteworthy contribution to British foundry practice in making available an economical melting unit for which can be claimed such important advantages as unique flexibility, exceptionally-rapid melting, extremely-close control of analysis, temperature, etc., unusually-low metal losses, and production of homogeneous metal having excellent physical properties. The relative importance of the foregoing advantages depends, of course, upon the circumstances in which the equipment is used, but it is claimed that the Birlec-Detroit furnace stands alone in offering this combination of valuable features backed by the invaluable experience gained during over sixteen years' extensive use in America, where upwards of 700 such installations are in regular service.

The furnace employs a horizontal, cylindrical melting chamber on the axis of which a single-phase arc is established between two graphite electrodes. The chamber is oscillated continually about its axis during melting, and thus stirs the bath of metal, while, at the same time, ensuring its intimate contact with all parts of the heated lining, thereby providing an exceptionally high melting speed. The chamber is effectively closed during melting, and therefore limits metal loss to a very small amount, while, at the same time, reducing both radiation losses and the consumption of electrodes to minimum values.

A single unit of this type, having an easily-cleaned melting chamber of simple shape, may be used for a wide range of metals and alloys without alteration, this versatility being a very valuable feature. It is further noteworthy that the charge may be made up largely or entirely of cheap scrap materials such as turnings, borings, etc., and high-quality metal can therefore be produced at very low cost. In the ferrous foundry the high, controlled degree of superheat obtainable is exceedingly useful, while in non-ferrous work the exceptionally-low metal loss and the assurance of uniform composition throughout a melt are similarly important features.

The Birlec-Detroit rocking electric-arc furnace is made in a wide range of types and sizes to suit every requirement, and several examples are already in successful use in this country in both ferrous and non-ferrous foundries.

The range of heat-treatment with which the name of Messrs. Birmingham Electric Furnaces, Limited, has been associated for many years past, will be exemplified by a 40-kw., batch-type furnace of a design suitable for annealing, carburising, reheating and a wider range of similar duties, together with a forced air circulation



BIRLEC-DETROIT ROCKING ARC-MELTING FURNACE, MODEL AA, OF 1,000-LB. COLD-METAL CAPACITY, BY BIRMINGHAM ELECTRIC FURNACES, LIMITED.

equipment representing the range of models produced for tempering, low-temperature annealing, the heat-treatment of aluminium piston pots and other such work involving low temperatures.

The former of these two furnaces will incorporate a heated door, controlled by a special system, in respect of which patent applications are in hand. This arrangement results in the maintenance of a uniform temperature throughout the furnace-hearth area, thus permitting the entire charging space to be effectively used without risk of uneven treatment or distortion in various parts of the charge.

The Birlec patented hook-mounted type of heating elements—notable both for its high efficiency and exceptional reliability under arduous conditions of service—is fitted to this furnace, the equipment, in this respect, exemplifying the practice maintained in the largest Birlec industrial heat-treatment installations.

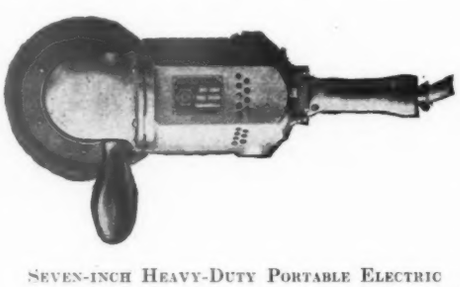
The small forced-air-circulation furnace represents a complete range of such equipments and offers exceptionally rapid and uniform heating at low temperatures, combined with genuinely economical operation. The patented charge progress recorder fitted to larger models of this type will also be demonstrated, this instrument being arranged to show the furnace operator at a glance when each charge has been raised to the desired temperature, thus minimising risk of incorrect treatment and waste of time through unduly prolonged heating.

An important part of the exhibit as a whole will be a series of illuminated photographs illustrating the extremely wide range of work covered by Birlec heat-treatment and melting equipments. Each of these photographs will show an actual industrial installation regarding which full technical details will be available.

In addition, a number of technical and descriptive publications will be available for the examination of visitors, describing the special Birlec equipment which has been developed for such processes as the bright annealing, brazing, nitriding, continuous heat-treatment operations of all kinds, enamelling and many other classes of work. Fully-detailed technical information will be available on these and other subjects and will be placed gladly at the disposal of visitors.

BENCH AND PORTABLE TOOLS

The stand of *Black & Decker, Limited*, of Slough, Bucks, is of distinct interest to those having charge of the fettling shop, as it shows a number of electric grinders, either portable, bench or pedestal mounted. The double-ended grinders are shown in three sizes to take 6-, 7- and 10-in. wheels. In most cases both the guards and the rests are adjustable, whilst the



Seven-inch Heavy-Duty Portable Electric Sander by Black & Decker, Limited.

switch is very conveniently placed in the base plate of the machine. An interesting tool shown is a 7-in. heavy-duty portable electric sander, provided with a right-angle drive. It is largely used for smoothing the surface of castings. Other exhibits are portable electric drills, screwdrivers, nut tighteners and similar electrically-driven small tools.

SPECIAL PIG-IRONS*

The firm of *Bradley & Foster, Limited*, of Darlaston, Staffs, is a specialist producer of "refined" and "refined alloy" pig-irons in a large variety of grades for use in the production of high-duty castings. Each grade is of guaranteed composition, controlled within close limits and uniform throughout each consignment. A patented process for degasifying the metal is used during manufacture of the pig-iron to ensure the best casting properties on remelting. A special feature is made of technical sales service, and the company's staff is available for consultations on problems relating to metal mixtures.

The exhibit comprises a range of fractures of pig-irons, including cold-blast and cylinder qualities; degasified pig-irons; chromium pig-irons; nickel and nickel-chromium irons; molybdenum irons; copper and tungsten pig-irons. A section of the stand is devoted to exhibiting samples of chilled-steel abrasives, the manufacture of which has recently commenced. Considerable attention is being devoted to the question of quality and wearing properties, and there is evidence of the growing importance of metal abrasives for cleaning castings. Mr. J. H. D. Bradshaw will be in attendance throughout the duration of the exhibition, and for various periods Mr. G. T. Lunt, managing director, and Mr. J. E. Hurst, technical director, will also be available.

PLUMBAGO AND FOUNDRY SUNDRIES*

Apart from general tools and requisites, *British Foundry Units, Limited*, of Retort Works, Chesterfield, are showing various grades of Crulin core oils and compounds, parting powder, different grades of coal dusts, blackings and foundry fluxes, for all metals. A section of the stand is devoted to the products of the De Mel Mines of Ceylon, and a special display of plumbago in all its various forms and stages will be exhibited. A new type of crucible furnace, which was described in our issue of July 4, page 13, is included. Mr. C. Wood, Mr. J. L. Beecroft and Mr. F. J. Barraball, London representative, are in attendance on the stand.

TOWN'S GAS EXHIBIT

The British Gas Federation, 28, Grosvenor Gardens, show a 3-ft. by 2-ft. by 1-ft. natural-draft oven furnace in which demonstrations will be carried out, supplemented by a number of smaller ones for various heat-treatment jobs. Included amongst these are a combustor-type oven furnace, a pot furnace, and a salt-bath furnace with agitating gear; rotating-hearth furnace; belt-conveyor furnace, and a rotary carburising furnace. Visitors may have their own specimens heat-treated. Furnaces exhibited in the metal-melting section include crucible and bale-out furnaces and soft-metal melting pot, Linotype and Monotype pots.

INDUSTRIAL GASES AND THEIR APPLICATION

The range of oxy-acetylene welding and cutting equipment now made by the *British Oxygen Company, Limited*, of Victoria Station House, London, S.W.1, for the multifarious applications of the oxy-acetylene process is so extensive, that at best the section of their stand devoted to this class of equipment can only serve to indicate the general possibilities. Having an experience of over twenty-five years in supplying blowpipes for many widely differing purposes, it is almost certain that the company can satisfy the need however unusual or difficult it may appear. In addition to a comprehensive display of high- and low-pressure oxy-acetylene outfits for welding metals and for cutting steels, cast and wrought irons, there will be shown oxy-coalgas, and air-acetylene equipment for brazing, melting, surface heating, soldering, paintburning, and lead-burning, as well as blowpipes for glass-working. Various types of pressure regulators will be another feature of this section. A selection from the range of "Alda" welding rods and fluxes will be available for inspection and test as well as materials for hardsurfacing, etc.

Oxygen Machining.

With its advantages of speed, economy, and scope, oxygen machining is a production method of universal appeal to engineers. The machines exhibited comprise the 55 in.—a precision machine comparable to a machine tool which is capable of producing parts of any shape which can be inscribed in a semi-circle of 55 in. radius from steel plate or forgings 14 in. thick and over, and some small portable power-driven types for cutting straight lines of any length and circles of any diameter upwards of 15 in. from material up to 4 in. thick. The latter, with their special swivel-cutting heads, are designed especially for trimming plates; the preparation of boiler, tank, and drum plates; the preparation of welding bevels; and the shaping of machine frames and ships' plates. Although it is understood that the demonstrations of the oxygen-cutting machines on the stand will be carried out employing mild steels, it should be noted that the machines may be equally well used for cutting parts from nickel, nickel-chrome, chrome-molybdenum, high-carbon, stainless, tungsten, and cobalt steels as well as from manganese steel and cast irons. Laminated packs made up from steel sheets for electrical work likewise may be cut by the oxygen-cutting machine.

Electrical Arc-Welding.

With the extensive use to-day of oxygen machining, many engineers have found that their production work may be made still more effective and economical by the joint use of electric arc-welding for fabricating oxygen-machine cut parts. The requirements of this class of work have long been known and studied by the company, who, as sole selling agents in Great Britain and Ireland for the electrodes of the Ferro-Arc Welding Company, Limited, are in a position to give an exceptional service to all who contemplate taking up or extending this modern production method.

The exhibits in the electric-welding section include Ferro-Arc electrodes specially suitable for shipbuilding and structural steel work, and a 250-amp. single-operator motor generator set. Various types of Ferro-Arc electrodes for welding cast iron with or without preheating, and types for welding stainless and heat-resisting steels, will also be exhibited. The company's electric-welding staff will be pleased to advise upon the selection of electric-welding equipment and electrodes and will gladly demonstrate any type of electrode in which the visitor is interested.

Metal Spraying.

A new exhibit is the British high-speed unit in the section devoted to metal spraying, whilst the pistol to be used in the metal-spraying demonstrations is the first of British manufacture to be exhibited by the company. This tool functions with the use of oxygen and hydrogen in conjunction with compressed air furnished by a British Ingersoll compressor. It is of a capacity for dealing with the spraying of non-metallic surfaces only. Metal spraying, it should be explained, is a process of depositing any metal or alloy obtainable in the form of a wire on to any metallic or non-metallic surface for protection against corrosion, atmospheric attack, or simply for purposes of decoration. The British high-speed unit enables a heavier deposit to be applied than was possible hitherto. It also has the advantage of being quicker in operation. Other features of the metal-spraying section include a rotary nozzle for spraying the inside of tubes, a deflector nozzle for spraying at angles

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of 45 deg., an extension nozzle for spraying inaccessible parts, and a special patented mass-coating drum combining the operations of sand-blasting and spraying for the treatment of small parts in bulk such as bolts, nuts, screws, and washers, the drum being in the form of a hexagonal rumbler.

Dissolved Acetylene Lighting Equipment.

As one of the most important and largest pioneer firms engaged in the manufacture of all classes of equipment for temporary lighting using dissolved acetyiene, the British Oxygen Company is in the position to advise upon almost any problem of temporary lighting confronting road contractors, railway engineers, builders, and demolition contractors. The ability to give unvarying illumination of anything from 5,000 to 10,000 candle-power throughout the roughest weather, with the minimum of attention and at the lowest possible cost, has been the inviolable standard of the company's "Alda" dissolved acetylene lighting equipment. Types of flare-lights and inspection lights from the "Alda" range will be exhibited on this section of the company's stand.

SPECIAL PIG-IRON*

British Pigirons, Limited, of Abbey House, Victoria Street, London, S.W.1, will exhibit representative examples of "Midhill" and "Glenhill" Allmine special pig-irons, together with fractures, test-pieces, microphotographs, etc. This firm claims to be the pioneer in Great Britain in supplying pig-iron to definite guaranteed analysis coupled with the appropriate fracture. The above brands are smelted at their associated works in Scunthorpe, Lincs, and are to be found in regular use throughout the most important foundries in the engineering world. These popular brands are produced in cylinder, chilling and special foundry qualities, and, owing to the diversified analysis of the stocks carried, the firm is in a position to give prompt delivery of pig-iron to almost any practical specification in these grades. It should be particularly noted that the pig-irons exhibited are guaranteed blast-furnace products and are not refined or subjected to any secondary heat-treatment. The company is in a position to supply material to meet the demands of the most discriminating users, and particularly for the production of high-grade castings subjected to the highest mechanical and pressure tests. The Technical Department exhibits a comprehensive range of microphotographs up to a magnification of 2,000 and complete pig-iron mixtures are recommended for all types of castings, on application, of which service visitors are invited to make full use. The personnel in charge of the exhibits is as under:—Mr. G. B. Taverner, managing director; Mr. R. A. Martin, B.A. (Chem.), general sales representative; Mr. I. H. Baker, Midlands representative, and Mr. C. T. Monseur, Continental representative.

PNEUMATIC TOOLS

The exhibits on the stand of *Broom & Wade, Limited*, High Wycombe, are of direct interest to foundry owners, and comprise a representative display of this firm's pneumatic tools. Amongst these may be examined chipping hammers suitable for fettling and dressing every type and size of casting. They are available in various sizes varying in weight from 5¼ to 13½ lbs., and are shown on the stand in their latest form, embodying the main distributing valve of an improved sleeve or hollow piston type, which gives an unusually high speed of blow and maximum cutting power. The hammer illustrated in Fig. A is the smallest in the range of "Broomwade" pneumatic chippers, but it incorporates all the features of the larger types. It weighs 5¼ lbs. and delivers 3,000 blows per minute, consuming 10 cub. ft. of free air per minute. This tool is available with both grip or straight close-corner handle.

Of other tools, indispensable for modern foundries, mention may be made of pneumatic sand rammers, an example of which is shown in Fig. B. They are built in three sizes, having the net weight of 21½, 19½ and 7½ lbs. respectively. The smallest size is suitable for bench work, and is capable of delivering 1,050 powerful blows per minute, consuming only 12 cub. ft. of free air per minute. They are all particularly smooth in operation and ensure good castings due to uniform ramming of the moulds.

FIG. B.—SAND RAMMER.

FIG. A.—CHIPPING HAMMER.

FIG. C.—GR2-TYPE GRINDER.

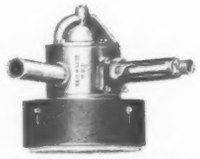


FIG. D.—PR3-TYPE GRINDER AND POLISHER.

FIG. E.—PLUMBAGO SPRAY.

PNEUMATIC TOOLS FOR FOUNDRIES BY BROOM & WADE.

There are also shown pneumatic brushes and grinders of rotary type, which provide the simplest method of removing the sand from castings and of securing a clean surface. In the "Broomwade" grinder, which is illustrated here in Fig. C, the speed and air consumption is governed; this important feature helps to obtain economical running of the tool and prolongs the wheel life. The standard types are provided with automatic oil lubrication, alloy-steel spindles and large ball bearings. By using such grinder with wire-brush attachment, each casting received individual treatment with consequent saving of time and labour. The "Broomwade" range includes a grinder shown in Fig. D, which is used for dressing and surfacing large castings. It incorporates all the features of the other types, and in addition is provided with the guard adjustable to wheel wear. The power of this tool is sufficient for wheel of 5 in. diameter. With slight modifications it can be used with a sanding disc of 9 in. diameter.

Amongst other tools of interest to foundry owners there is a plumbago spray, illustrated in Fig. E. It weighs only 12 ozs. and is invaluable in the foundry for spraying plumbago or water evenly and rapidly on to the moulds.

In addition there are exhibited single-stage, single-acting compressors of various sizes, ranging in actual capacity from 3 to 130 cub. ft. of free air per minute, at 100 lbs. pressure, which are of the most reliable and thoroughly modern design, incorporating the full force-feed lubrication, increased cooling area and all the latest mechanical refinements. They are particularly suitable for foundry use, being of the totally-enclosed, dustproof type, and having efficient air filters.

AIR COMPRESSORS

Two examples—a compressor and a steam engine—from the range of manufactures of *Messrs. J. Browett Lindley* (1931), *Limited*, Letchworth, Herts, form the chief exhibits. Both machines are arranged to run at slow speed, and are provided with internal illumination so that the motion work and forced-lubrication system can be seen in actual operation. The compressor shown is of the two-stage type, having a capacity of 1,000 cub. ft. of free air per minute to 100 lb. pressure. Control is automatically effected by means of an unloading valve on the air inlet, though it should be noted that other methods have been developed, and are fitted to meet individual conditions. Hoebiger type ring-plate valves giving an extremely small vertical lift are employed. These are accessibly situated in valve chambers designed to give minimum clearance space with maximum volumetric efficiency. The small lift provided by this type of valve, together with the use of unusually wide bed, are two of many factors which result in quiet and steady running. The cylinder design is such as to ensure perfect transmission of heat to the cooling water, thus giving cool operation, and the pistons are solid castings with deep spring rings which prevent leakage without exerting undue pressure on the cylinder walls.

HIGH-DUTY REFRACTORIES*

The stand of the *Carborundum Company, Limited*, of Trafford Park, Manchester, displays a wide range of Carborundum brand refractories including bricks, tiles, special shapes, tubes, muffles, crucibles, firesand and cement. As is well known, Carborundum is a super-refractory material, being produced in the intense heat of the electric furnace. It cannot be melted and it possesses an extremely low coefficient of expansion coupled with high-thermal conductivity. Carbofrax will withstand the highest temperature, resist abrasion, and does not spall or crack under rapid changes of temperature. Its great value in the upkeep of high-temperature furnaces is definitely established.

The Alfrax bricks which are shown are principally composed of electrically-fused alumina ("Aloxite").

Carbofrax and Alfrax enamelling muffles have the advantage of long life with low fuel consumption, giving high production at low burning costs, properly burned ware, with definitely uniform distribution of heat.

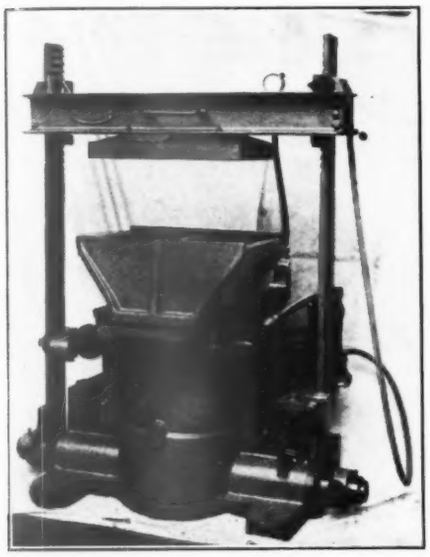
Carbofrax and Alfrax hearth tiles shown are suitable for heat-treatment furnaces; it is claimed that they will stand up under the trying conditions of heat-treating heavy articles, as they show remarkable resistance to abrasion and will not soften or sag.

Carbofrax and Alfrax cements are used for high-temperature furnace repairs and fixing of Carbofrax and Alfrax bricks, while Carborundum firesand is extensively used by non-ferrous metal industries, for monolithic linings.

Carborundum crucibles are becoming ever more popular for the melting of ferrous and non-ferrous metals. These crucibles possess such advantages as long life, no annealing treatment required (as they do not absorb moisture), withstanding unlimited heat, and being unaffected by being cooled between heats.

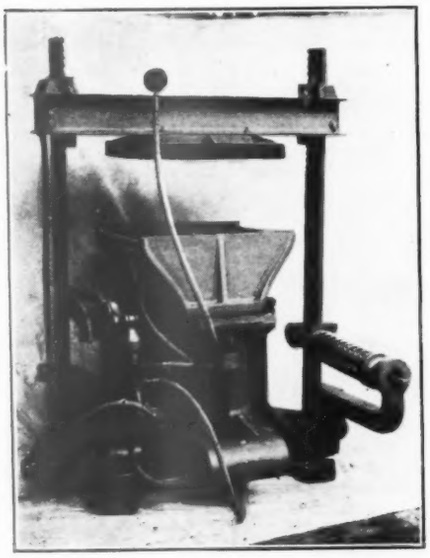
MOULDING AND CORE MAKING MACHINES*

The stand of the *Coleman Foundry Equipment Company, Limited,* of 156, Strand, London, W.C.2, is one of the very few featuring moulding machines. The two machines shown have both been designed by Mr. C. W. Coleman. One is a split pattern, power-squeeze and draw



PLAIN SQUEEZE MOULDING MACHINE BY COLEMAN FOUNDRY EQUIPMENT COMPANY.

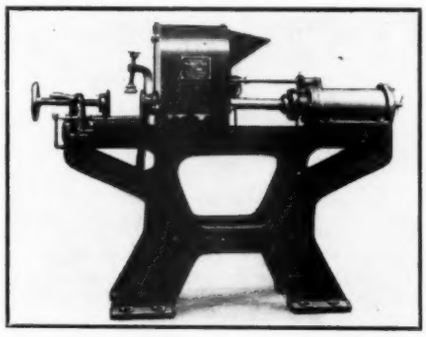
machine, with open ends and adjustable sides. The size of moulding box used is limited only by the weight one man can comfortably handle. The second is a jar-ram, split pattern, power draw and squeeze, with the same open ends and adjustable sides as in the squeeze machine. These exhibits are supplemented by several core-blowing machines of the well-known revolver type. The capabilities of this machine will be



BACK OF THE "COLEMAN" SQUEEZER, SHOWING OIL TANK USED IN CONJUNCTION WITH THE DRAWING MECHANISM.

exemplified by examples of cores produced from them, together with the production types. The machine, since its introduction a few years ago, has become a firm favourite alike with the largest quantity production foundries as with the pure jobbing shops.

Another exhibit which is bound to attract attention is the Coleman-Prosama sand mixer. This machine disintegrates, revivifies, aerates and throws the sand from it as quickly as a couple of men can shovel. The stream can be controlled to fill storage hoppers, and can thus



THE SMALLEST "REVOLVER" CORE-MAKING MACHINE SHOWN BY COLEMAN FOUNDRY EQUIPMENT COMPANY.

be usefully incorporated in continuous production foundries. A vibratory sand-sifting machine of new design completes the exhibits.

SCOTTISH PIG-IRON*

Colvilles, Limited, 195, West George Street, Glasgow, C.2, are exhibiting samples of Dalzell, Glengarnock, Clyde and Monkland Foundry qualities and Clyde Special and ordinary hematite. These will be in the form of pigs as cast. A series of fractures shows No. 3 Clyde, No. 3 Glengarnock, Nos. 1 and 3 Dalzell special low-phosphorus, No. 4 Close Dalzell foundry qualities, Clyde hematite and Clyde basic. Sample pigs and fractures of Dalzell special refined pig-iron, the special feature of which is its low carbon content, this being 3 per cent. maximum, are shown. This iron is extensively used for the manufacture of high-duty castings. Several specimens of castings are shown which have been made from mixtures of these irons, and show the high quality and finish obtained by their use.

PNEUMATIC TOOLS*

The Consolidated Pneumatic Tool Company, Limited, of 170, Piccadilly, London, W.1, will exhibit a complete range of their well-known portable Boyer pneumatic hammers for riveting, chipping, caulking, tube beading, fettling castings, billet chipping, stone dressing and carving, boiler scaling, cleaning off old paint preparatory to re-painting; pneumatic rammers for the foundry; also their latest designs of power vane and Little Giant drills, grinders, sanders and polishers. An electrically-driven air compressor will be installed, controlled by an automatic starter and cut-off switch. This plant will supply air for demonstrating the various pneumatic tools, all of which will be shown in operation. They are also showing a complete series of their Hi-cycle, high-frequency electric tools and Little Giant Universal electric tools for drilling, reaming, screw-driving, nut and stud running, grinding, sanding and polishing, indeed, for every operation requiring a rotary motion.

FOUNDRY MELTING PLANT*

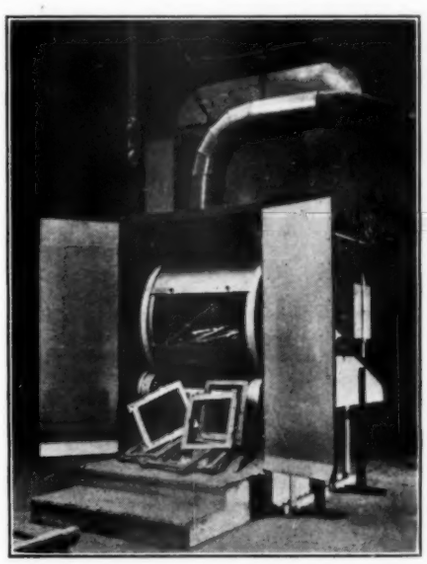
The stand of the *Constructional Engineering Company, Limited,* Titan Works, Charles Henry Street, Birmingham, is unique inasmuch as it exhibits cupolas. The Titan cupola is shown by a bottom section. It is a 5-ton-per-hr. plant and has embodied in its design patented and other improvements, including solid-drawn mild-steel tubular columns, reinforced base plate, reinforced slagging and fettling holes, and patent tuyere control arrangement providing independent adjustment of tuyeres, inspection door of equal area to tuyeres, incorporating separate sight hole and poking hole. These features are exclusive to, and original features of, "Titan" cupolas; there are now upwards of 2,000 "Titan" cupolas installed. The cupolas are designed to give maximum melting efficiency with ease of operation. Photographs of complete installations, including mechanically-charged plants, are also exhibited. An important feature for export is that the "Titan" cupola can be specially constructed to minimise freight.

Examples of the improved "Titan" cupolette, self-contained melting unit, made in capacities of 10, 15 and 20 cwts. per hr. are on the stand. Over 1,500 of such plants are in use at home and abroad.

A model of the E.G. Patent spark arrester, which is claimed to be the most efficient apparatus yet designed, is being shown.

The "Sand Wizard," recently described in our columns, which cleans castings, forgings, etc., without the use of compressed air, is being shown in operation. It is built in rumbler and rotary-table types, and by eliminating air compressor, etc., reduces the power consumption by 80 to 90 per cent. The maintenance charges are reduced by a similar percentage. The quality of the work is improved, the time taken in cleaning is reduced, the quantity of work increased. The machine is practically noiseless, and also possesses other advantages over the normal sandblast machine. Standard sizes of rumbler type machines range from 25 in. dia. to 60 in. dia., whilst rotary table types are 28 in. to 90 in. dia.

A full range of ladles from the geared-crane ladle with totally-enclosed oil-tight gear box to



THE "SAND WIZARD" EXHIBITED BY THE CONSTRUCTIONAL ENGINEERING COMPANY.

hand shanks is being shown, as are also bogie ladles with ball-bearing carriages.

Improved "Titan" shaking barrel for cleaning castings, stampings, etc., by wet or dry process, and the "Titan" sand dryer complete the machinery exhibits. The latter is a new machine for drying sea sand, etc., which is extremely economical with fuel and highly efficient. This dryer is built for oil or coke fuel, and has capacities varying from 30 cwts. to 8 tons per hr.

A full range of pattern-plates and oddsides made of "Titanite" is being shown. This material is also suitable for making moulds for die-cutting machines, etc. The exhibits include a pattern-plate from which upwards of 50,000 moulds have been made.

In attendance on stand there are Mr. D. H. Wood, managing director; Mr. C. H. Aiken; Mr. F. J. Barraball; Mr. W. Christoffers; Mr. L. H. Hines; Mr. J. Hutchinson; Mr. W. J. Molineux; Mr. J. T. More; Mr. E. Norman, jun.; and Mr. Padgham.

XUM

FOUNDRY FACINGS*

Wm. Cumming & Company, Limited, the well-known foundry facings manufacturers and foundry furnishers, whose head office is at Kelvinvale Mills, Maryhill, Glasgow, and who have branch works at Falkirk, Chesterfield, Deepfields, and Middlesbrough, will show their usual comprehensive display of foundry facings. This firm, which is by far the largest in the trade in this country, has a world-wide renown for excellence of productions. In addition to the blackings, they import plumbago direct from Ceylon. This is graded, processed and sold direct to the foundries, a distinct recommendation.

For a long time efforts have been made to place upon the market coal dusts which shall answer to exact specifications, and by dint of laboratory control and expert manipulation, the problem seems to have been solved. Now it is possible to obtain a coal dust to special requirements, and the new machinery which has been installed tends to make the finished product definitely standard.

Of late years Wm. Cumming & Company, Limited, have been branching out into various directions, and the success of their parting powders, core gums, pattern-plate compounds and other specialities of like nature, has been most marked. But perhaps the item which has most enhanced their reputation for attention to detail and realisation of performance is the new Cumming crucible furnace, which has more than filled the anticipations of the patentees. Repeat orders for these furnaces have followed from many firms whose idea was to establish one or two, but who have found them so economic in operation as to extend their operations more and more. Demonstrations are being given on the stand of an 80-lb. furnace, and a new 150-lb. furnace, specially lined to a customer's order, will also be exhibited, though not under heat.

The attendants at the stand are all practical men, some of whom are exclusively employed as service men for aiding foundry executives with their production problems.

INDUSTRIAL RESEARCH EXHIBIT

One of the main features of the exhibit arranged by the Department of Scientific and Industrial Research is a cinema display illustrating various aspects of industrial research and the industrial background in which the research work finds application.

Among the films to be shown are some describing the work of various departments of the National Physical Laboratory including one describing the work of the William Froude Laboratory on the design and testing of ships' hulls and another illustrating the work of the Radio Department of the Laboratory. This latter film explains in a simple manner the action of the cathode-ray oscillograph which provides the most sensitive means of recording rapidly varying electric currents known to science and is, therefore, an instrument of the utmost importance in modern radio research. With this film will be shown demonstrations of the application of the cathode-ray oscillograph to radio direction-finding at sea and its use in a new type of compass. Industrial films to be shown will include films on ship building, the manufacture of propellers, the manufacture of brass strip and extruded rod, and films dealing with the production of iron and steel.

In addition to the cinema display exhibits are provided illustrating some of the work of the William Froude Laboratory of the National Physical Laboratory, the Fuel Research Station, the British Non-Ferrous Metals Research Association, the British Cast Iron Research Association, and the Industrial Research Council of the British Iron and Steel Federation. The stand will be attended throughout the exhibition by technical experts who will welcome discussion with visitors. A bureau at which reports and other literature may be consulted and purchased forms part of the stand.

British Cast Iron Research Association

The exhibit of the *British Cast Iron Research Association*, 21-23 St. Paul's Square, Birmingham, 3, shows some of the directions in which the work of the British Cast Iron Research Association has contributed to the remarkable improvement in quality of cast iron which has been achieved in recent years.

Moulding Sands.

The grading of a moulding sand can be determined by several methods, the most accurate of which is "elutriation." An elutriator is designed so that an upward current of water in a closed-glass system is maintained at a given velocity sufficient to carry over particles less than a certain size. By increasing or decreasing the velocity of the water stream, particles of greater or lesser diameter can be separated.

The elutriator demonstrated is of the "Crook" type, and is useful for showing the separation of the three main grain sizes of a moulding sand. The clay, shown suspended in the upper vessel, is being carried away through the jet at the water exit. The silt is seen in suspension at the bottom of the upper vessel and at the top of the lower vessel, whilst the coarse sand material is seen at the bottom of the lower vessel. The experiment is concluded when all the clay material has been carried away, which is denoted by the clarity of the water in the upper vessel.

Grouped round the elutriator are samples of sands used in British foundries; these have been taken from all the prominent industrial areas. In addition, graded materials can be examined under a microscope.

Structure Modification in Cast Iron.

In the past, the only means available to the iron-founder whenever he required to vary the properties of cast iron have been the changing of the chemical composition or else varying the rate of cooling of the casting in the mould. While these methods have been satisfactory up to a point, they have certain serious disadvantages. For instance, if a very strong iron is required, the measures adopted to obtain it cause the molten iron to possess very poor founding properties, so that sound castings become more difficult to make.

Recent work by the association, however, has shown that it is possible to attain these objects without having to resort to drastic changes in the chemical composition or without having to introduce a special technique in the moulding in order to govern the rate of cooling. For instance, it is now possible, in irons of the same composition, to have totally different structures and consequently very different properties. An iron in which the graphite, for instance, is in the extremely coarse condition, can have a transverse strength of 15 tons per square inch. Without varying the composition in any way but by controlling the melting, the strength can be raised to double this figure without introducing any fresh difficulty in the founding.

This is illustrated in the exhibit by fractures of 3 in. diameter bars representing melts subjected to various treatments which have modified their structures and properties. The effect produced by the treatments on the structure can be seen by an examination of various specimens under the microscope.

British Iron and Steel Federation (Industrial Research Council)

Steel forgings of one type and another are employed in almost every branch of engineering, and the quality and reliability of forgings can be directly traced to the ingots from which they are made. For example, when molten steel is poured into ingots and castings, the resulting mass is not perfectly homogeneous. The study of this and other related phenomena is engaging the attention of the Heterogeneity of Steel Ingots and Steel Castings Research Committees; and the results of their researches will be of interest to all those who employ steel in either the forged or cast form.

Work in hand at the moment is of a more fundamental nature. The Committee is investigating methods of determining oxygen and non-metallic inclusions in steel, as well as the effect of the conditions of manufacture upon their concentration and distribution. Another aspect of the work covers the whole subject of gases in steel and the manufacture of semi-killed, balanced, and rimming steel.

Under the Steel Castings Committee, which has already published one report which has been widely read, research has been instituted by studying in considerable detail a number of commercial castings. In this way it has been possible to form a reasonably accurate picture of the various defects and imperfections which may occur in castings, and to correlate this picture with the conditions of manufacture. Having completed this preliminary study, the work is being developed in more specialised channels to determine the exact effect of the various factors involved.

For instance, research is being carried out at the Research Department, Woolwich, on the mechanical strength of castings at temperatures just below their freezing point. The question of fluidity, as distinct from temperature, is also being investigated in detail; and, in conjunction with the Heterogeneity Committee, research is in hand upon the whole question of oxygen in steel.

Future developments in this programme will probably include a fundamental research into the mineralogical and physical properties of different moulding sands, and a study of the volume changes occurring in steel on cooling from the molten condition.

Ultimately, this work of a fundamental nature will be applied to ordinary foundry practice in determining, for instance, which are the most satisfactory melting processes for each particular type of casting, the effect of carbon and alloy content upon freedom from cavities and cracks, the factors which must be controlled to reduce hot pulling and tearing to a minimum, and the numerous other problems which confront the foundryman in his everyday work.

British Non-Ferrous Metals Research Association

The British Non-Ferrous Metals Research Association, Regnart Buildings, Euston Street, N.W.1, is represented by an exhibit illustrating the progress made in three of its fifty-five major researches which have been completed or which are still in progress. The subjects chosen are the corrosion of condenser tubes, the founding of aluminium alloys, and the electrodeposition of metals.

Research on aluminium founding has been largely concerned with the causes and avoidance of pinholing in cast, particularly sand-cast, aluminium alloys. The fundamental cause of this defect, which is the evolution of hydrogen by the solidifying metal, is shown to be due to the differing solubility of hydrogen in the liquid and solid metal. Hydrogen contamination can occur during melting by reaction with the furnace atmosphere, particularly with water vapour, and can also result from corrosion of the metal in the solid state prior to melting. Specimen castings illustrate the occurrence of pinholes in castings after exposure of the metal to unfavourable conditions of storage or melting. Methods of treating the molten metal prior to casting to remove dissolved hydrogen are also illustrated, and the high degree of success resulting from the use of suitable degassing processes is indicated.

PNEUMATIC AND ELECTRIC TOOLS

With the semi-mechanisation of the fettling shop, increased speed of cleaning is being demanded. An exhibit which caters very largely for this department is that of *Desoutter Bros.*,

Limited, The Hyde, Hendon, London, N.W.9, who show numerous examples of both pneumatic and electric portable and bench grinders. Amongst new exhibits in this field is a powerful 6-in. electric grinder. All the tools shown are under power.

WOOD-WORKING MACHINERY

Dominion Machinery Company, Limited, Hipperholme, Halifax, are showing a wide range of high-class woodworking machines, including a No. 6 Mortiser. This is a new product for hollow chisels only, and is capable of mortising up to 1 in. square. The machine is fitted with a motor which is mounted vertically into the machine, thus eliminating belts. Another feature is the neatly arranged blower which operates immediately over the hollow chisel to keep the work clear of chippings automatically.

The Super Elliot and the Model Elliot woodworkers which do the work both with and across the grain, are shown under power. These machines are capable of ripping, cross cutting, mitring, compound mitring, planing, thicknessing, rebatting, chamfering, stop-chamfering, stair stringing, tenoning, ploughing, grooving, moulding and boring, etc., without dismantling any part of the machine and with less than a minute to change over from one operation to another, and with the timber travelling in the same direction for all operations.

A surfacing and thicknessing machine which is made in three sizes, 16 in. by 9 in., 20 in. by 9 in. and 24 in. by 9 in. is expected to be on show. This machine is driven by a single motor and the power is transmitted direct to the cutterblock by multiple Vee belts, and to the feed mechanism by flat belt drive to the three-speed gear box, and from there by Hans Renold steel roller chain, giving three smooth rates of feed. The cutterblock is arranged so that moulding irons can be inserted without dismantling the planer irons and moulding can be done either over the surfacer or through the thicknesser.

An all-electric cross cutting and trenching machine will be on show under power. It is used for cross grain work such as cross cutting, mitring, compound mitring, stair stringing, tenoning, trenching, grooving, ploughing and boring, etc. It takes up little space as the timber travels the same way for all operations. It can be set to the side of the shop.

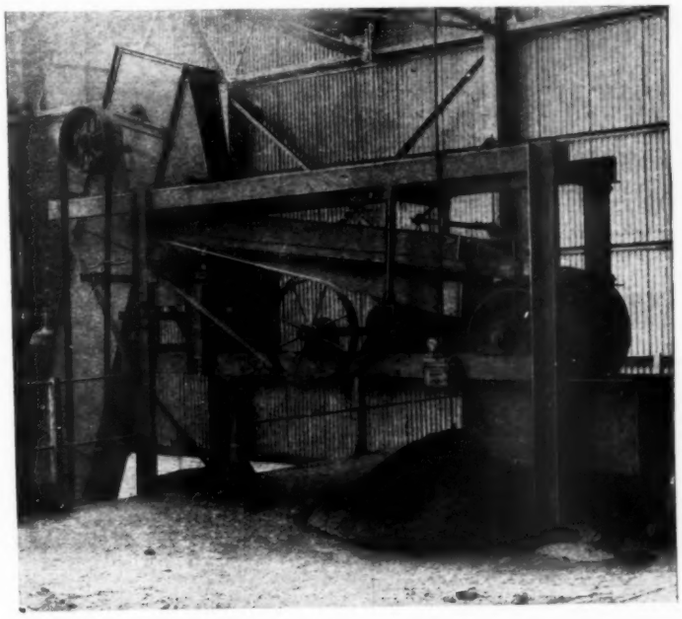
Various types of belt sanding machines are manufactured by the Dominion, one of which is expected to be on show, the sizes available being 6 in., 9 in., 12 in. and 14 in. wide, together with the open end belt sander or pad sander, which is capable of handling any length of timber up to 4 ft. wide. A saw bench in operation completes the exhibit.

ELECTRO-MAGNETIC EQUIPMENT*

An effort has been made on the stand of *Electromagnets, Limited*, of 2, Church Street, Birmingham 3, to include representative exhibits of the three principal groups of their manufactures—lifting magnets, separators and clutches. For the first group, a circular type of lifting magnet, working in conjunction with an electric hoist, is shown as a means of demonstrating the power when lifting loads magnetically.

A complete range of lifting magnets would of course include not only the circular pattern, but also rectangular bipolar and tripolar patterns, one or other of which meets practically all industrial requirements, in steel works, foundries and the like for handling skull cracker ball, ingots, billets, sections such as girders, joists, tubes and light scrap, borings, turnings, etc.

In the group of magnetic separators it has been decided to demonstrate the new types of high-efficiency machines which are of recent development, and therefore of more interest than previously known types. Magnetic separators are mainly operated for purification purposes, preventing damage to crushers, grinders, pulverisers, and handling plant, etc.; also for extracting iron for its value. Actually they are extransmission and for fixing to balancing machines; also where they are desirable in connection with variable speed hoists and winches, breakdown gear in rolling mills, or starting up A.C. motors under full load conditions and as

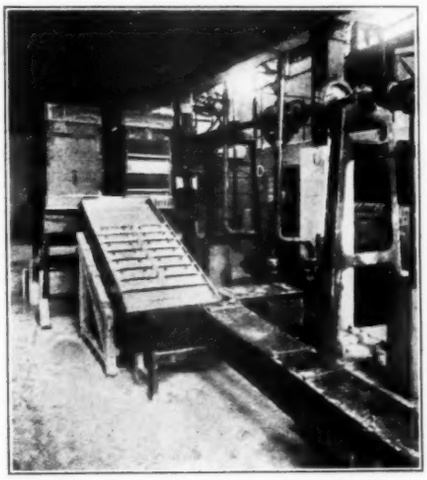


ELECTRO-MAGNETIC SEPARATOR INSTALLATION FOR DEALING WITH FOUNDRY SAND BY ELECTROMAGNETS, LIMITED.

hibiting a rotary drum separator, and the demonstration given consists of separating mixed swarfs resulting from machining operations.

For dealing with powders, a new type of separator is also being demonstrated and this particular machine is the only one on the market where the coil box remains stationary and the magnets are jig-shaken laterally as distinct from a forward and backward movement. Many advantages have been shown of the use of this action as against other previously known types.

Another separator which is being demon-



AN ELECTRO-MAGNETIC SEPARATOR FOR ENAMELS BY ELECTROMAGNETS, LIMITED.

strated is in the form of a shute which is suitable for dealing with liquids such as enamel, and the like, whilst further equipments under this group in the form of bench, suspension and hand magnets, chiefly used in the metal industry for separating and detecting mixed swarf, scrap, rod ends, etc., are also being shown.

Dealing with the last group, clutches are made for various purposes in connection with general safety devices for calender rolls as is the case in connection with rubber, linoleum, brick and other manufactures.

CHINA CLAY AND REFRACTORIES*

English Clays Lovering Pochin & Company, Limited, of St. Austell, Cornwall, are the largest producers of china clay or kaolin in the world, and their exhibit is principally confined to this mineral. The kaolinised granite found in the china-clay mines of Devon and Cornwall combine in the natural material the best proportions of alumina and silica, and in the most pure form together with very low alkalis and absence of harmful fluxes. Made at the company's own brickworks, situated on the china-clay mines, with every facility, the resulting bricks combine the highest heat-resisting properties with very long life.

The "Martin Lee Moor" firebrick has been known for more than 100 years as a high-grade firebrick (Cone 32-33, or 1,710 to 1,730 deg. C.). "Lee Frac," a recent development in high-duty refractories, should be of particular interest for special furnaces, where high temperatures and trying atmospheres are encountered, as it attains Cone 34-35 (1,750 to 1,770 deg. C.).

A range of the company's silica (quartz), sands and gravels is also shown in various grades, some of which are suitable for foundries.

An attractive exhibit is a working model of a china-clay mine, where the whole process of production can be seen and will be explained. The company also exhibits Carbis Sunburn fireplaces, and "Trepol" scouring powder, which is particularly suitable for foundries, ships, hotels and kitchens.

English Clays Lovering Pochin & Company, Limited, also exhibit their colloidal kaolins, manufactured under their own patents, for use in manufacture of marine paints, varnishes, etc.

CRACK DETECTION

An electro-magnetic crack detector is shown on the stand of *The Equipment and Engineering Company, Limited*, of 2 & 3, Norfolk Street, Strand, London, W.C.2. The underlying prin-

ciple is that the part under test is highly magnetised with the correct amount of magnetism, by means of powerful electro-magnets. The pole pieces of these are so shaped that the sample laid across them completes a magnetic circuit of low reluctance. If a crack exists the lines of force are broken and the crack is revealed by the application of a special graphitic ink made for the purpose.

PULLEY BLOCKS

On the stand of *Felco Hoists Limited*, of 17, Victoria Street, London, S.W.1, is set out an extremely wide range of chain blocks, runways, rope hoists, and chain slings, all of British manufacture. Mr. L. J. Tichelly, who is well known in the foundry industry, is in attendance on the stand.

CORESHOP-MACHINERY AND CORE COMPOUNDS*

Core-making machinery constitutes the principal exhibit of the *Fordath Engineering Company, Limited*, of Hamblet Works, West Bromwich. The mixing of sand and oil, or

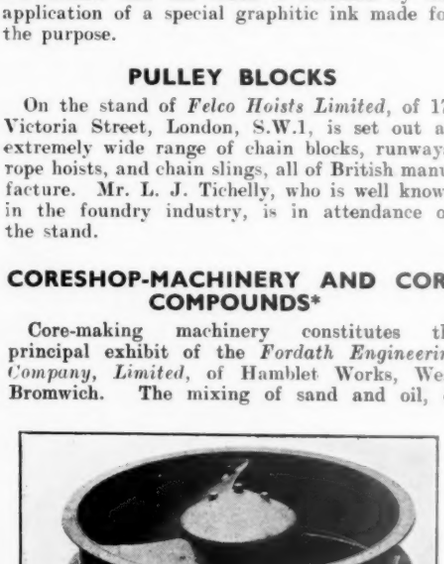


FIG. A.—THE ROTOIL SAND-MIXING MACHINE BY THE FORDATH COMPANY.

indeed any type of foundry sand, is shown by two machines, the Senior and Junior Rotoil mixers. The general construction is shown by Figs. A and B, from which it will be seen that the machine is characterised by the fixed

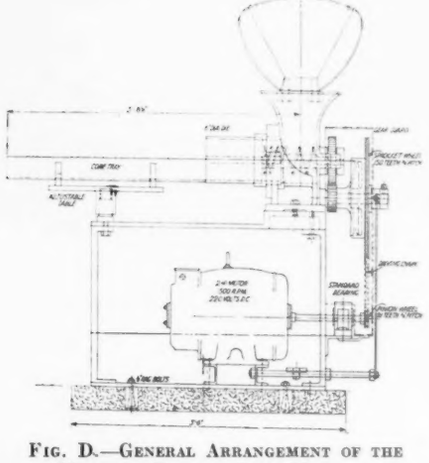


FIG. D.—GENERAL ARRANGEMENT OF THE MULTIPLE ROTARY CORE MACHINE BY FORDATH.

pressure blades made from chilled iron, beneath which rotate blades attached to the central hub. The protection of the moving parts has been very intelligently carried out, whilst the discharge arrangements make the machine capable of continuous performance. When batch mixing with the No. 4 model, however, 4 cwt. is mixed in two to four minutes, according to the nature of the bond. The machines are arranged for either motor or belt drive.

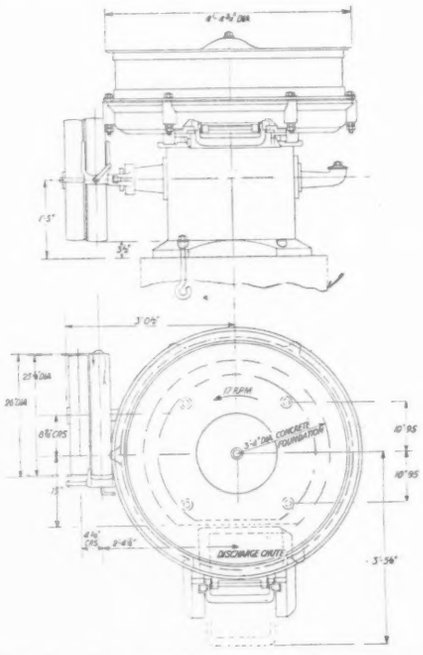


FIG. B.—PLAN AND ELEVATION OF THE ROTOIL SAND MIXER BY THE FORDATH COMPANY.

The multiple rotary core machines which are shown are a striking advance from the original nuclear idea—the simple sausage mincer. These machines are arranged for both hand and power operation, and are capable of making an infinite variety of parallel core, and in fact as many as

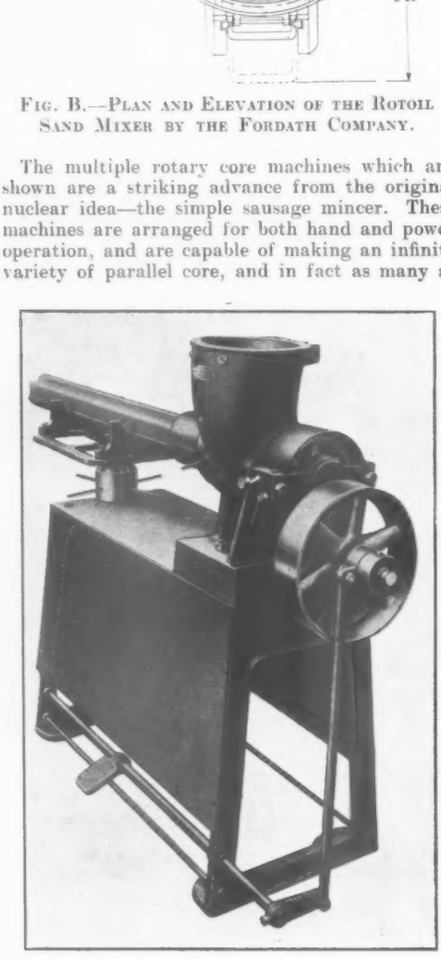


FIG. C.—MULTIPLE ROTARY CORE-EXTRUSION MACHINE BY THE FORDATH COMPANY.

twenty cores of varying section can be extended simultaneously. A feature is the conveyor, standardised for all sizes, which consists of a parallel barrel. Upon this are built up start threads, which present a corresponding number of pressure surfaces adjacent to the face of the die. Each die carries its own venting device, whilst the extension holes are accurately ground to predetermined dimensions. Two models are shown, Senior and Junior, the latter having a capacity of $\frac{1}{8}$ in. to three inches, or multiple ones up to $1\frac{1}{2}$ in. dia. This machine is shown in Figs. C and D. Other exhibits include the Newman Hender core box vice, which prevents the destruction of expensive boxes by eliminating rapping; refractories for furnace linings, especially applicable to cupolas and rotating furnaces; mould and core dressings; and a mould-spraying material to eliminate scabbing and drying, which is known as Fordaval. Finally, there are to be numerous cores made from the well-known "Glyso" core compounds.

REFRACTORIES IN GENERAL*

General Refractories, Limited, of Genefax House, Sheffield, is the only firm in Great Britain producing refractory materials of every type. Their activities embrace every branch of the refractories industry from supplying foundry-moulding sands to basic bricks for steel production. The exhibits include specimens and demonstrations of most of their materials. Special mention should be made of the complete range of foundry sands, as this firm has at its disposal more than 50 varieties of refractory sands from quarries in all parts of the country. Among these are Bramcote, Levenseat, York Yellow, Hollinwood, Red Rover, Thanet, Zenith, Pickering, Harperley moulding sands and K.L. Minimum, Maximum, core sands, etc. Yorkshire sand, the well-known steel-moulding sand, is also exhibited.

Of particular interest to steel founders is the recent introduction of "Chamotte" moulding compositions. With these materials it is claimed that heavy-steel castings may be produced more economically and with better finish. General Refractories Limited make ground ganister at several works situated in all the important industrial areas in order to facilitate low carriage charges. Special work has been conducted with considerable success in the perfecting of Albino for lining rotary-melting furnaces.

Firebricks of all types are manufactured by General Refractories, Limited. Perfection in shape and size indicates the extreme care taken in this matter, which in modern-furnace construction is of vital importance. Specimen sleeves, nozzles and stoppers are exhibited, together with cupola linings, boiler-furnace-linings materials, etc. Silica bricks are displayed for steel furnaces, coke ovens and gas plant.

The use of heat-insulating materials which play such an important part in modern-furnace building has been fully realised. The new "Insulite" bricks and compositions having remarkably low-thermal conductivity are shown with demonstrations of the heat savings which may be effected with them.

Supermag, Diazite and other basic refractories for open-hearth steel furnaces, electric-steel furnaces and copper furnaces are other specimens shown. This firm specialises in basic refractories and has devoted considerable research in this direction. Its efforts are reflected in the excellent service results obtained not only in England but in Europe and the Dominions.

FLEXIBLE DRIVEN TOOLS

Messrs. F. Gilman (B.S.T.), Limited, of 221, High Street, Smethwick, Staffs, are exhibiting a full range of their portable flexible drive machines. There are included a number of portable grinders, the smallest of which uses a $\frac{1}{6}$-h.p. motor, and takes wheels of a maximum diameter of $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. width of face. Other machines driven by a $2\frac{1}{2}$ to 3 h.p. motor take 10-in. diameter wheels up to 2-in. width of face.

Similar machines for sanding and dressing castings of all kinds, and for use with wire or other rotary brushes are also shown. The

range of machines exhibited by this firm comprises portable sets with handle carriers, machines for suspension from over-head "T" rails, machines for bench and floor mounting. Flexible drives of all sizes and lengths are incorporated according to the nature of work to be performed, and handpieces both of the straight and right-angle drive pattern are available for use with ordinary wheel-shaped heads, or cup wheel face type heads.

Multiple speed equipments will be exhibited which enable a wide range of grinding sizes and shapes of wheels and other fittings to be used, and special attention has been given by this firm to the production of equipments for die-grinding, finishing and polishing work. For this purpose a very wide range of rotary grinding tools, millers, files, rasps and other fittings are provided.

TIME RECORDERS*

The exhibit of *Messrs. Gledhill-Brook Time Recorders, Limited*, of Empire Works, Huddersfield, includes a comprehensive display of total adding, receipt issuing, self-closing, coin-exhibiting and multiple drawer check tills, and a particularly interesting display of semi- and fully automatic time recording machines for attendance, time and cost distribution, card recorders for workmen's time checking, portable metal case recorders for outside use by gangs of men, and signature recorders for staff time checking.

OXYGEN CUTTING MACHINES

Messrs. Hancock & Company (Engineers), Limited, Progress Way, Croydon, are showing a range of oxygen-cutting machines in which they have specialised for many years. Different types of profiling machines are shown in operation, together with several portable models. The profiling machines will include a Universal Simplex and a direct-cutting and profiling machine.

The Universal Simplex profiling machine is the latest type of oxygen-cutting machine and is fitted with a Universal-electric tracer giving four interchangeable forms of drive, *viz.*, direct from a drawing, automatically from a template of strip aluminium, semi-automatic and automatic from a wooden or soft-metal plain or channel template.

The Simplex machines are made in three cutting areas. The one exhibited is the No. 2 model with a cutting area of 60 in. x 40 in. and it will profile absolutely in shape within this area, straights and circles being automatic.

The direct-cutting and profiling machine is a No. 2A size with a cutting area of 42 in. x 30 in. and this machine is also fitted with a Universal electric tracer giving four interchangeable drives.

In addition to these two profiling machines three portable machines are being exhibited, namely:—Portable Auto; Circaline, and Profiline.

The first two are straight line and circle cutters and the third is a portable profiler. Each machine is entirely self-contained and the cutting speed can be adjusted when running. All these cutting machines run off the lighting supply and are supplied with motors for either A.C. or D.C.

SCIENTIFIC INSTRUMENTS*

The stand of *Charles Hearson & Company, Limited*, 27, Mortimer Street, London, W.1, and 68, Willow Walk, London, S.E.1, sole agents in Great Britain for the Reichert metallurgical microscope, contains the first exhibition in this country of the recently-developed M.E.A. Reichert metallurgical microscope. This will have considerable interest for metallurgists, as the instrument combines the optical assembly—a dropped microscope of the Le Chatelier type—as used with the Reichert M.e.F. universal microscope, so modified for adaptation to the spring-suspended girder-frame optical bench of the well-known Reichert E.M.1. It is fitted with both a low-voltage electric lamp and an arc lamp for visual work, photomicrography and macrography. Observation can be made in transmitted, reflected or polarised light under various forms of illumination, and in light or dark field. Rapid light transition and quick interchange of optical components are notable features. Both the M.E.A. and M.e.F., together with a range of small Reichert bench metallurgicals, will be demonstrated on their stand.

Other exhibits will include Hearson electric furnaces for general heat-treatment of metals and Hearson thermostatically-controlled ovens for low-temperature annealing, moisture-content determinations, etc. Various types of thermostats as applied to cabinets for core and mould drying will also be shown. In attendance on the stand are Mr. E. H. P. Jones, director; Mr. R. Janda, Mr. H. J. Bellamy, Mr. A. V. Davies and Mr. J. A. Sanders.

SODIUM CARBONATE PROCESS*

Imperial Chemical Industries, Limited, Imperial Chemical House, Millbank, London, S.W.1, are showing sodium carbonate for the refining of cast iron and non-ferrous metals. There will be displayed granular sodium carbonate and fused sodium carbonate blocks; the plant used in the process; and samples of ferrous and non-ferrous castings already treated.

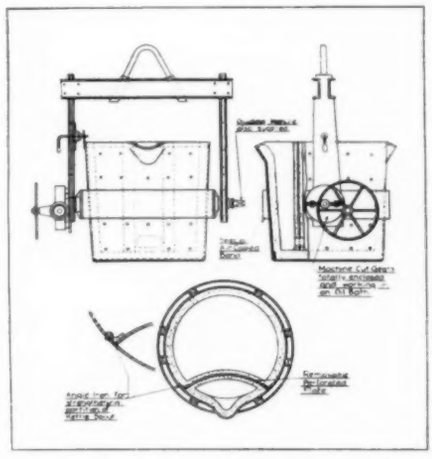
The Process.

The sodium carbonate process consists of the treatment of metals with a highly-reactive slag which has a refining, degasifying action, and removes sulphur, oxides, silicates, etc. Castings so treated are sounder and free from porosity, and have better machining properties, while for those required to withstand hydraulic pressure the treatment is specially useful. The reduction of the sulphur content is of particular value in connection with steelmaking, and with sodium carbonate it is frequently possible to use a cheaper mixture in the cupola.

Special Plant.

Recent progress in this application of sodium carbonate has revealed the need for special plant, and the central exhibit on the I.C.I. stand will be a specially-designed teapot ladle which facilitates the separation of slag from metal and thus increases the efficiency and speed of the process. This type of ladle can be used either as a receiver or for direct castings, and plant lay-outs will be illustrated.

For use in the ladle the granular form of the chemical is provided. It is a dust-free product of a high degree of purity and is widely used in the treatment of blast-furnace and mixer metal, and of iron castings of all descriptions where low-sulphur content, clean metal, freedom from porosity and blowholes, and uniform machinability are required.



TYPE OF LADLE RECOMMENDED FOR THE SODA-ASH PROCESS—I.C.I. (ALKALI), LIMITED.

Fused Blocks.

The other form of sodium carbonate for foundry uses is the fused block, weighing 4 lbs. This is suitable for addition to the cupola charge, or for the treatment of non-ferrous metals when it is required to plunge the flux below the surface of the melt by means of a perforated bell. Its use makes the slag more fluid and keeps the furnace lining clean so that repair costs are reduced to a minimum.

THE STAND OF IMPERIAL CHEMICAL INDUSTRIES IS UNIQUE INASMUCH AS THE CENTRAL PORTION TAKES THE FORM OF A CUPOLA.

Other Uses.

Sodium carbonate is also used as a flux in the melting of brass and bronze swarf, where it

prevents loss of zinc by volatilisation and removes entrained oxides and other non-metallic inclusions; in the modification of aluminium silicon alloys; and in connection with the basic-open hearth, acid and basic Bessemer, and Tropenas processes.

Mr. B. B. Houston will be in charge of the stand.

TECHNICAL EXHIBITS*

The exhibit organised by the *Technical Committee of the Institute of British Foundrymen*, demonstrates the application of scientific investigation to modern foundry practice. The exhibits include sample castings, test bars and photomicrographs showing properties and special applications of castings made of cast iron, steel, malleable cast iron and non-ferrous metals. Sample castings include cast-iron crankshafts, austenitic iron castings, hardened and tempered cast irons, corrosion-resisting irons and steels, castings in alloy steel and valve castings used for investigating properties of steel castings.

Sand-testing apparatus is being shown as well as charts outlining the results of investigation on cupola linings and patching materials, and on the applications in non-ferrous foundry practice of various types of furnaces.

Reports on foundry melting costs are available for inspection.

Among those in attendance will be Mr. J. W. Gardom, Convener of the Technical Committee; Mr. T. Makemson, Secretary of the Institute; honorary officials of the Institute and members of the Technical Committee. They will be glad to discuss the Institute's activities with those who are interested, and will arrange for the proposal of candidates for membership.

HIGH-DUTY CAST IRON*

The *International Meehanite Metal Company, Limited*, are exhibiting jointly with British licensees. They are Ashmore, Benson, Pease & Company, Limited, Parkfield Works, Stockton-on-Tees; Cameron & Roberton, Limited, South Bank Iron Works, Kirkintilloch; Ealing Park Foundry, Limited, Junction Road, London, W.5; G. M. Hay & Company, Limited, Strathclyde Foundry, 86, Cotton Street, Bridgeton, Glasgow; and Winget, Limited, Rochester, Kent. Meehanite metal is manufactured by twelve foundries in Europe and thirty in America under licence.

Meehanite metal is a cast ferrous material controlled to meet definite service requirements, and possesses superior physical properties to cast iron and semi-steel. It has replaced steel, manganese steel and malleable cast iron, and finds many applications where severe service conditions exist (*e.g.*, miscellaneous dies, rock crushers, cement plants, dredger and pump parts, etc.).

Amongst the advantages claimed for this material are that the physical properties are accurately controlled and guaranteed to definite specification; uniform strength and solidity. This is illustrated by an exhibit of test-bars from 1 in. to 5 in. square, cast from the same ladle, the fractures of which are practically identical and show no "openness" in the centre). There is also shown a sectioned and polished 8 in. sq. bar which is uniform in Brinell hardness; other advantages claimed are resistance to heat, eliminating growth, distortion and premature failure and reduced scaling to a large degree. There are also irons to resist corrosion by acids and alkaline solutions.

Process "A" Meehanite is regularly cast with a tensile strength of 25 tons per sq. in. and upwards (figures in excess of this are consistently obtained), a modulus of elasticity of 21,000,000 and a Brinell hardness of 196 to 600 as desired. Superior wear- and corrosion-resisting properties, together with a fatigue strength double that of semi-steel and an impact value (Charpy) six times that of grey iron, are obtained.

Service requirements normally place a casting in one of the following classes, and the exhibit will show examples and photographs of castings falling into these groups:—(1) General engineering castings; (2) heat-resisting castings; (3) wear-resisting castings; (4) chemical-resisting castings; (5) chilled castings; and (6) heat-treated castings. Meehanite can also be hardened and tempered to give strength or ductility.

The exhibit illustrates how Meehanite can be employed by the designing engineer by charts showing very complete specifications of the material. These figures are perfectly dependable, and are guaranteed. This is unique in the cast-iron world. Photomicrographs are shown illustrating the very fine and regular graphite distribution, being similar to the nodular form encountered in malleable cast iron.

A comprehensive exhibit of castings has been arranged with special reference to high-duty parts. The suitability of Meehanite metal for this purpose is shown by a number of camshafts and crankshafts of heat-treated Meehanite supplied to prominent automobile manufacturers. Dies cast to a fine finish (*i.e.*, no machining is necessary), cylinder liners, gears, pump parts, laundry-machinery parts (replacing malleable cast iron), goosenecks, brake drums, pipe 20-ft. by 4-in. dia. (for sewage), castings for cement plants, rock crushers, cement mixers and parts produced by a continuous casting plant, show the wide adaptability of the material which is finding an increasing demand in all industries.

TIME RECORDING

International Time Recording Company, Limited, of International Works, Beavor Lane, Hammersmith, W.6, as well as exhibiting a representative range of their many popular types of time recorders, are also exhibiting their exclusive automatically-supervised electric time system. The International master clock controlling the system sends an electrical impulse once every minute to every unit it controls, which may include time recorders, clocks, time-signalling apparatus, etc. On receipt of this impulse all units move forward one minute. In addition, once every hour the master clock automatically corrects or *supervises* the perfect time agreement with itself of every unit it controls, thus ensuring perfect time uniformity throughout the building or ship.

SCIENTIFIC INSTRUMENTS

Whilst one invariably associates high-grade microscopes with the name of *E. Leitz (London)*, of 20, Mortimer Street, London, W.1, their stand includes a universal dilatometer. This instrument is used for determining transformation points; for ascertaining the nature and magnitude of strain in castings; for testing the "growth" of cast iron and for investigating such problems as "refining" and differences presented by cold- and hot-worked materials.

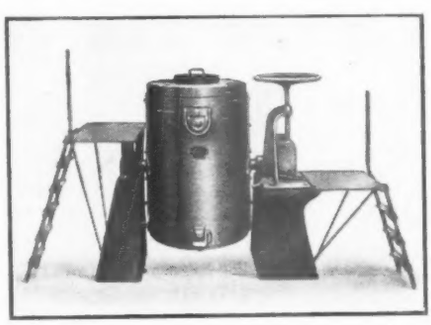
A second exhibit of outstanding interest is the Ultropak illuminator which has of recent years been applied more and more to industrial purposes. It affords means of examining any surface, however extensive or however highly reflecting, at all magnifications, in incident light without previous preparation. It can be used with both ordinary and polarised light, and is eminently suitable for taking photomicrographic records. It is interesting to note that while the Ultropak can be adapted to any existing microscope, its recently increasing applications to industrial microscopy have rendered necessary the creation of an entirely new series of stands specially adapted for this purpose. The catalogues available on the stand are worthy of special notice as they are veritable text-books on the subject of microscopy.

NICKEL IN CAST IRON

The display on the stand of the *Mond Nickel Company, Limited*, of Thames House, Millbank, London, S.W.1, is designed to familiarise technicians with the exceptional services available to them through the Bureau of Information on Nickel and the Research and Development Department. Foundrymen will have the opportunity of ascertaining at first hand and under ideal conditions just what progress has been made during the last six or seven years in the amelioration of cast iron by the addition of nickel, either alone or in conjunction with other alloying elements. That very substantial progress has been made will be evident from the exhibits in the form of castings or photographs of products made by foundries enjoying an international reputation for quality. Non-ferrous foundrymen will find they, too, are well catered for by a number of interesting exhibits. Readers are invited to make themselves known to the metallurgists on the stand so that they may receive future literature, as it is published.

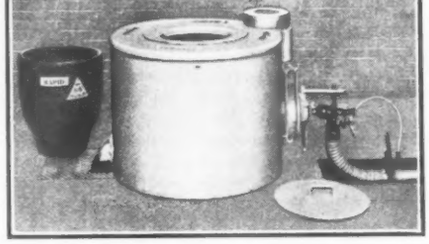
CRUCIBLES AND FURNACES*

Crucibles in infinite type and variety form the general background of the stand of the *Morgan Crucible Company, Limited*, of Battersea, London, S.W.11, whilst the floor is set out with some half-dozen models of furnaces. Type CA is a 400-lb. brass-capacity furnace, which is either oil- or gas-fired, and is repre-



OIL-FIRED TILTING FURNACE BY MORGAN CRUCIBLE COMPANY.

sentative of a range of ten models, having capacities ranging from 150 lbs. to a ton. It is commonly used for brass, aluminium and gunmetal, and is finding increasing popularity for melting alloyed cast iron, as the metallic losses are extremely low, whilst the running costs are distinctly modest. As a number of metallurgists and foremen still prefer coke as a melting medium, a really efficient furnace is shown—



OIL-FIRED BALE-OUT FURNACE BY MORGAN CRUCIBLE COMPANY.

Type S, of 250 lbs. capacity, representing a range of sizes running from 150 to 1,000 lbs. capacity. The essential feature of this furnace is the full protection of the metal from the products of combustion.

In the light alloy foundry there is, as an exhibit, a bale-out furnace, which can be either town's gas or oil fuel fired. It has been designed with a view to maintaining for prolonged periods aluminium and its alloys at the correct casting temperature, without overheating. The exhibit

is of 300 lbs. capacity, and typifies a range running from 50 lbs. to 10 cwts. capacity in terms of aluminium.

The Type P furnace is exhibited as a No. 3 model, representing a capacity range running from 30 to 350 lbs. brass content. It is designed for high-temperature duty, such as for the melting of steel, cupro-nickel and nickel. Natural draft, coke-fired furnaces will never completely disappear from the foundry, and a well-designed example representative of a dozen sizes is shown in the smallest model made, that is 40 lbs. capacity. The largest takes 400 lbs. (brass capacity) crucibles.

A new design of brazing furnace, either gas or oil fired, completes the exhibits of melting plant. It is largely used for dip-brazing turbine blades and cycle frames. The temperature is quickly attained and closely controlled to predetermined limits, which makes for economical working.

Refractories.

A separate department exhibits a range of the grades of firebrick manufactured at the works of the associated company, The Douglas Firebrick Company, Limited, Dalry, Ayrshire. These include "Douglas," "Douglas A," "DFC," and special materials, such as "Triangle W" (non-spalling fireclay), "Triangle V" (52/54 per cent. alumina), "Triangle V.5" (Sillimanite), etc. The shapes show the application to suspended arches and walls, heat-treatment furnaces, cupolas, and other types of furnace settings.

The exhibit also includes special refractories manufactured at Battersea, for example "Triangle CC" (silicon carbide), "Triangle V.55" (fused alumina), with illustrations of the application to enamelling furnaces, while there will be a representative range of ware for which the company has been well known for many years, namely clay crucibles, muffles, scorifiers, refractory tubing, etc. Apart from the fireclay mixings, there will also be included specimens of the latter in Sillimanite, fused alumina, silicon carbide, aluminous porcelain, and pure oxides.

ELECTRIC WELDING

The stand of *Murex Welding Processes, Limited*, of Forest Road, London, E.17, is surrounded by welded-steel frames which illustrate the trend of steelwork design for modern industrial buildings. The frame is such as would be used for supporting a railway station roof and consists of a central span of 30 ft. and two side cantilevers of 10 ft. each.

The vertical alternator shown has been loaned by the English Electric Company, Limited, and from the photographs it will be seen that the centre bearing bracket consists of a circular centre "pot" to which are keyed and bolted the 6 cantilever type arms which support the whole generator. Inside the "pot" are located the Mitchell thrust bearings which take the whole weight and thrust of the moving parts. The whole of the centre bearing bracket is of welded construction, the "pot" being of heavy rolled plate, rolled to size with flanges welded on. The weight of the structure is 9½ tons and the "spread" across the arms is 13 ft. 6 ins. The rating of the water turbine which drives the generator is 14,000 h.p. The speed is 250 r.p.m. and the total downward thrust that this bracket has to sustain is 132 tons.

A third exhibit is a standard 17 ft. 6 in. steel underframe for a 12-ton covered goods wagon. Welded joints are utilised in lieu of riveted lug and gusset attachments. The frame was prepared and welded at the Dukinfield Works of the L.N.E.R. and is representative of hundreds they have constructed in their works. The saving in weight as against a riveted frame is 17 per cent. This frame was welded with Murex Cresta electrodes utilising Murex motor generators.

An exhibit manufactured by Messrs. Samuel Taylor & Sons (Brierley Hill), Limited, consists of a mechanical davit of the "LUM" type geared, and is constructed throughout by electric-arc welding. The electrodes used in the manufacture of these davits are Murex Medex.

In addition to the large range of electrodes for the welding of both ferrous and non-ferrous metals, which are being shown, together with numerous samples of welds, there is on display a large selection of Murex arc-welding plant and equipment Included in this part of the exhibit will be a two-operator "Peter Brotherhood" diesel engine electric-arc welding plant.

Other plant includes an engine-driven arc-welding set for one operator, complete with Morris industrial engine, a 600 amp. motor-generator set for high-speed welding, a single-carcass motor-generator plant for one operator, a three-operator oil-cooled transformer arc-welding plant, and a light welder, specially designed for welding light-gauge plate from No. 20 to 14 s.w.g.

The exhibit will also include two kiosks, one specially devoted to "The Welder," the firm's house organ, and other publications relating to arc welding, and the other showing a display of photographs illustrating the development of this process in the principal branches of engineering, in addition to a numerous selection of welded specimens.

MOULDING SAND*

Messrs. J. Parish & Company, Loam Quarries, Erith, Kent, are showing the five grades of Erith Loam—yellow, mild, medium, strong and extra strong. Castings are shown "as cast" and in the finished state representative of various branches of the foundry industry. These include iron, brass, aluminium and bronze. Parish's screened silica sand will be displayed in conjunction with a wide range of cored work. Special enamelled exhibits will be a feature of the exhibit indicative of one of the many sides of the industry. Messrs. Parish are arranging for inspections to be made of the loam quarry which has been functioning for 130 years, and will have a private car in attendance for that purpose by previous appointment. The stand is to be supervised by Messrs. R. W., J. N. and Paul Talbot.

NON-FERROUS ALLOYS*

The object of the stand of *Messrs. T. J. Priestman, Limited*, of Cupro Foundry, Leopold Street, Birmingham, 12, is to demonstrate the economies that can result from the purchase of stock alloys. The vast experience possessed by this firm—they were established in 1872—has been directed to the creation of alloys to definite specification, which materially simplifies the work in the actual foundry. The range shown is particularly wide and includes many aluminium alloys, brass, gun-metal and phosphor-bronze.

WELDING

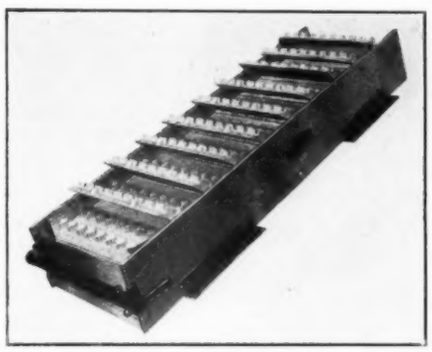
Philips Industrial (*Philips Lamps, Limited*), 145, Charing Cross Road, London, W.C.2, will exhibit on the welding side of the stand a completely new welding electrode, which is claimed to combine higher speed, greater efficiency, easy welding, increased elongation and complete reliability. The type 50 is an outstanding example, having a tensile strength of 31 to 35 tons per sq. in. with an elongation of 28 to 32 per cent. on an all-weld specimen. Electrodes for welding of high-carbon and special steels and non-ferrous metals are also being shown and demonstrated. They will also exhibit a full range of welding rectifiers, including new models giving both A.C. and D.C. welding. The well-known welding and battery-charger rectifier, Type 1303, is also being shown and demonstrated.

ELECTRIC WELDING

The Quasi-Arc Company, Limited, of 15, Grosvenor Gardens, London, S.W.1, has confined itself to the provision of a rest room, where appointments can be made for inspecting the permanent exhibit housed in their West End offices.

MAGNETIC SEPARATORS*

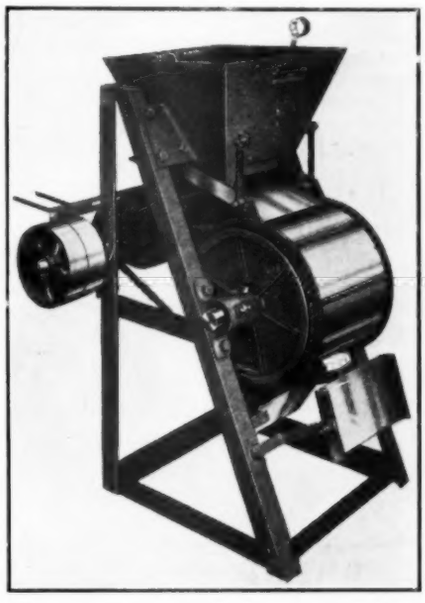
The stand of *The Rapid Magnetting Machine Company, Limited*, of Lombard Street, Birmingham, 12, is designed to include a comprehensive range of various types of magnetic separators, scrap-sorting magnets, lifting magnets, chucks and clutches, and the drum-type machines in



MAGNETIC SEPARATOR FOR VITREOUS ENAMEL BY THE RAPID MAGNETTING MACHINE COMPANY.

actual operation should prove of exceptional interest. The "Rapid-Biaflux" electro-magnetic drum which is admirably suitable for the treatment of foundry moulding sands is shown in operation.

A new type "J" magnetic separator will be demonstrating its efficiency on the separation of iron and steel from gunmetal, swarf, etc. This machine embodies a special magnetic unit which is so arranged that the iron and steel held against the face of the drum during rotation



ELECTRO-MAGNETIC SEPARATOR BY THE RAPID MAGNETTING MACHINE COMPANY.

gambols through alternate magnetic polarities, thus ensuring clean separation.

Another new development which will be shown working, is type "V" electro-magnetic separator of the oscillating shute pattern. This is so designed that the magnetic units and electrical windings remain stationary, being supported on a fabricated angle-section framework. Above these units is suitably mounted a tray contain-

XUM

ing special magnet bars which vibrates endways over the stationary units, the vibration being obtained by a special totally-enclosed mechanism, and besides the fact that the electrical windings are not under any mechanical stress, the machine takes very little power to drive.

Another machine which has already excited a considerable amount of interest is the "Rapidity" electro-magnetic separator, which is primarily designed to deal with feebly-magnetic ores. This machine will be shown in operation, and is claimed by the makers to be the fastest of its type so far designed.

Demonstrations of a medium-size "Circular" pattern electro-lifting magnet, which will be operated by means of a patent potentiometer pattern controller, are being given. It is raised and lowered by means of an electric hoist.

For the vitreous-enamelling trade this firm is demonstrating type "W" electro-magnetic separator in which new features have been embodied in order that enamels of various colours may be passed over the separator. By the new arrangement, the magnet bars can be very easily cleaned when changing from one colour to another and so avoid any contamination.

The exhibits also include various types of magnets for scrap sorting including the "Bench" type and "Hand" type. With regard to the latter, a new development has been embodied whereby a special control switch is fitted on the handle of the magnet itself for ease of control by the operator, which, compared with a switch mounted independently saves a considerable amount of time in releasing the iron extracted, and switching on again.

Electro-magnetic clutches and chucks will be on view: also a demagnetiser for use in conjunction with magnetic chucks.

Mr. M. Dudley Thompson and Mr. H. E. Hutter are in attendance at the stand.

AIR COMPRESSORS

Reavell & Company, Limited, Ranelagh Works, Ipswich, occupy the same stand as they have done for several exhibitions, and are showing a very comprehensive range of compressors and exhausters, and also a working exhibit of the Reavell-Askania regulator.

Dealing first with the air compressors, there are three examples of vertical, double-acting,

VERTICAL DOUBLE-ACTING TWO-STAGE AIR COMPRESSOR BY REAVELL & COMPANY, LIMITED.

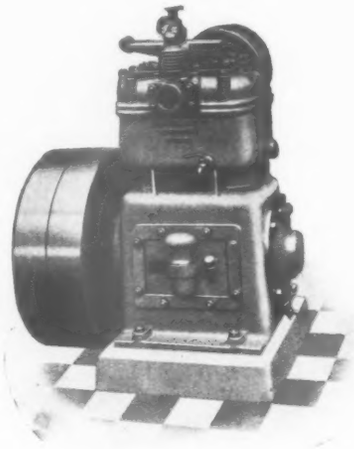
two-stage intercooled compressors of 1,000 cub. ft., 750 cub. ft. and 600 cub. ft. per min. capacity respectively, all suitable for a maximum working pressure of 120 lbs. per sq. in.

There is a range of nine sizes of vertical, single-acting, single-stage compressors varying in capacity from a three-cylinder machine of 300 cub. ft. to a little machine of only 2 cub. ft. per min. capacity. All are suitable for pressures up to 100 lbs. per sq. in. and, therefore, cover most ordinary requirements. There are also examples of the same type of compressor arranged as two-stage machines, models being shown suitable for 450 lbs. and for 1,000 lbs. per sq. in.

The compressor exhibit is completed by several of the well-known Reavell rotary compressors of the various types which they manufacture, including machines for low pressures up to 15 or 20 lbs. per sq. in., also a type of single-stage rotary compressor suitable for 40 lbs. per sq. in.

There are also a number of special types of compressors, including hand-driven machines.

The Reavell-Askania regulator is of the hydraulic-relay type, the relay consisting of a pivoted oil jet which impinges on two small



VERTICAL SINGLE-ACTING SINGLE-STAGE AIR COMPRESSOR BY REAVELL & COMPANY, LIMITED.

holes adjacent to one another, these being connected to opposite ends of the hydraulic-control cylinder which operates the valve or other control organ. The movement of the jet is controlled by a diaphragm-bourdon tube or other suitable impulse system, this being balanced by a spring in the case of constant-pressure regulators and similar controls. Details of the relay can be seen from the sectionalised regulator exhibited on the stand

A complete regulator is also shown, this being of the low-pressure type, such as is used for maintaining constant very low pressures of the order of only a few in. w.g. The regulator is mounted on the oil-pumping plant, which is self-contained and consists of a cast-iron pedestal, forming the oil tank, the oil pump and motor being mounted on the side. A typical butterfly valve with operating cylinder and linkwork is also exhibited and is connected to the regulator so that the operation can be seen.

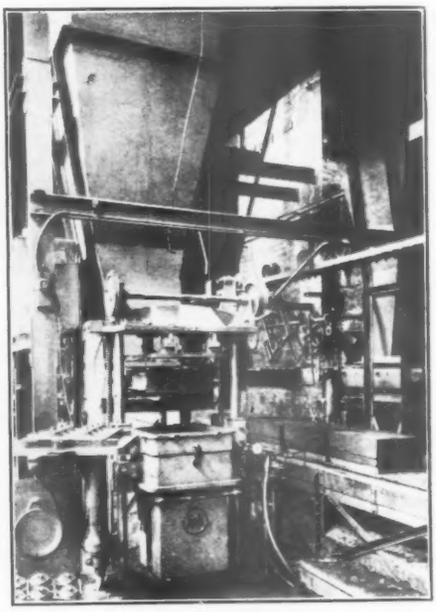
IRON CEMENT

Major, Robinson & Company, of 385, City Road, Cornbrook, Manchester, show samples of the "moulder's friend," that is, the well-known "Scols" iron and steel cement for filling blowholes. The colour-matching properties, its hardness and machinability are such as to command the attention of all those liable to have a surface blowhole in an unimportant place in a casting.

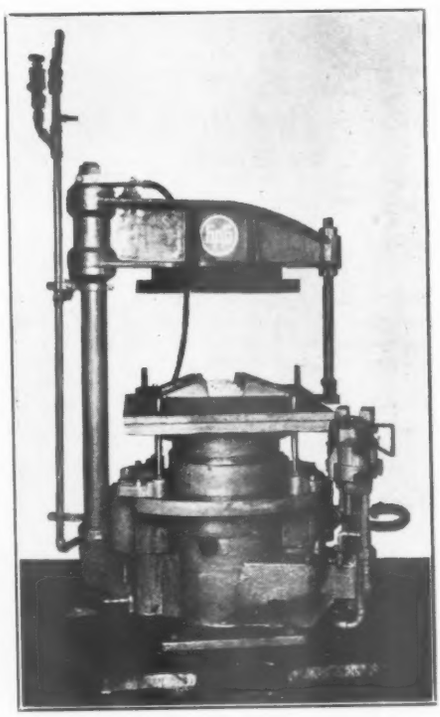
The firm's main exhibit, however, is a wide range of pipe-bending machines, which include both hand- and power-driven types.

MOULDING MACHINES*

The *Selson Machine Tool Company, Limited*, of 23, Abbey House, London, S.W.1, are showing two Hartüng moulding machines. The "Record" is a split pattern, jar-ram squeeze machine, and the "Pluto" a semi-automatic squeezer. The machine is of the boxless variety, which moulds both top and bottom half simultaneously, using compressed air at 80 to 90 lbs. per sq. in. All operations are controlled by the specially-designed rotary valve.



THE PLUTO SQUEEZE MOULDING MACHINE SHOWN BY SELSON.



THE RECORD SPLIT-PATTERN JAR SQUEEZE MACHINE SHOWN BY SELSON.

TINNING AND SOLDERING COMPOUND

The Soldo Company, of Sicilian House, Southampton Row, London, W.C.1, confine their exhibit to "Soldo," a powder containing a combination of fluxes and metal used for tinning and soldering all metals, except aluminium, whether rusty, corroded, greasy or oily, with no previous

preparation whatsoever, beyond the application of heat and "Soldo" alone. One of the most important uses of this material is for the "tinning" and "re-tinning" of all kinds of bearings, such as phosphor-bronze, brass, gun-metal, cast iron and cast steel.

ALLOYED CAST IRON

Sheepbridge Stokes Centrifugal Castings Company, Limited, of Chesterfield, exhibit typical components in special-alloy cast irons, manufactured either by their centrifugal process of casting where cylindrical shapes are required or as sand castings for more complex shapes. Amongst the more important of these special irons are the following:—"Centrard" (nitrogen-hardened) for abrasion and corrosion resistance, Brinell hardness up to 1,000. "Hypocrode" for corrosion and heat resistance. "Nicrosilal" and "Silal" for resistance to heat and scaling. "High Chrome" heat-resisting alloy specially recommended for annealing pots. "Centricast Mark II" chrome alloy for wear resistance, suitable for oil-hardening where thin sections are required. "Centricast Mark IV" nickel-chrome alloy for wear resistance and high strength, suitable for oil-hardening where thick sections are required. "High silicon" for acid resistance. Centrifugal-cast piston-ring drums and special die-cast alloyed iron rod will also be available for inspection. "Super Stokes" piston-ring pots are made of a crucible-melted special-grade material suitable for long service under superheated steam conditions. Non-lubricating piston-ring pots are of a special-purpose material intended for use under wet-steam conditions where pressure is low and lubrication by oil possibly inadequate. In addition, examples will be shown of their various heat-treatment processes, including oil and air-hardening and nitrogen-hardening.

CORE MACHINES AND CORE OILS*

Spermolin, Limited, of Halifax, are the pioneers of the core-oil industry in this country, having been established since 1908, and their products are well known throughout the world. Six different grades comprising oils, creams and semi-solids are now manufactured to suit all classes of foundry work, whether iron or non-ferrous. Where Spermolin semi-solid is employed the cores have the same "green" strength as those made from ordinary clay-bonded sand. For use with core-blowing machines Spermolin core compounds are specially suitable. On their stand they are showing a variety of oil-sand cores illustrating the uses of their products, also moulds made in oil sand as well as both ferrous and non-ferrous castings. A prominent exhibit is the Spermolin Patent sand-mixing machine, carrying a foolproof locking device which makes it impossible to start the machine until the safety grid is in the "closed" position, thus ensuring perfect safety for the operator. The machine is simple in construction, there being very few working parts to get out of order, and its erection is rapid, a bath of oil sand being thoroughly mixed in four minutes. Two sizes are available, the larger having a capacity of 2 cwts. and the smaller of 40 lbs.

The Spermolin Patent core-extruding machine, which is also being shown, produces round cores of any diameter from ⅜ to 3 in. Square, oblong and hexagonal cores can be produced to specification. The chief feature of the machine is the patent rising and falling tray carrier which adjusts the tray to the exact level of and parallel to the die, thus obviating the necessity of packing-up the tray, and eliminating bent and distorted cores. Mr. N. F. S. Winter (director), Mr. G. A. Smart, Mr. G. Senior, Mr. O. H. Wass, Mr. H. S. Wass, Mr. A. C. Turner and Mr. J. Winter are to be in attendance at the stand.

MOULDING BOXES AND WHEELBARROWS*

Sterling Foundry Specialties, Limited, of London Road, Bedford, will exhibit a comprehensive selection of their well-known Sterling rolled-steel moulding boxes of various types and sizes, for iron, brass, steel and aluminium foundries; also a range of Sterling all-steel tubular wheelbarrows, suitable for foundry and other purposes. Sterling moulding boxes are made from solid rolled-steel bars of special section which are formed by means of powerful presses into the correct shapes and sizes of moulding boxes required. The lugs and lifting handles are made of mild steel or malleable iron. This construction makes a box of maximum strength and rigidity, which cannot be cracked or broken and yet is light and easy to handle. Any special design of foundry moulding box can be supplied by this method of construction and any size of box from 9 in. square to 6 ft. square. Sterling wheelbarrows, which are also shown, are made in various types and with capacities from 2½ cub. ft. to 6 cub. ft. In addition to the general purpose barrows, there are barrows for special duties—for transporting sand, coal and coke, and pig-iron.

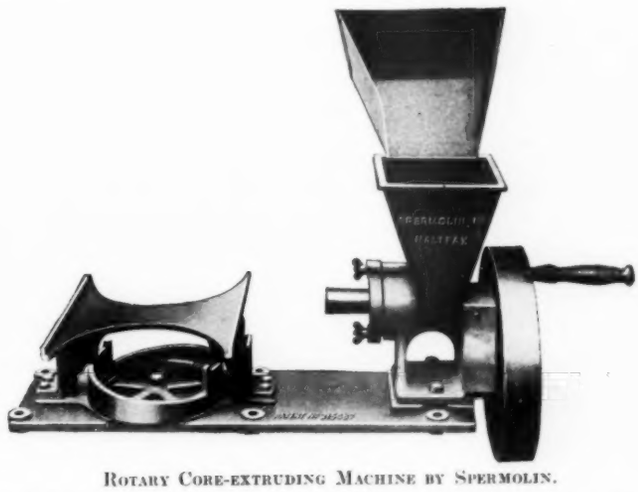
FOUNDRY RAW MATERIALS*

In order to demonstrate the utility of their brands of pig-iron, the firm of *Stewarts and Lloyds, Limited*, of London, Glasgow and elsewhere, show not only samples of their S. & L. and H.M. brands of pig-iron as such, but also in the form of finished castings, which have been lent by a large number of well-known foundries. Thus one sees on this stand such diverse articles as kitchen grates; gutters; porcelain enamel baths; gas and electric cookers; wash-hand basins; domestic heating boilers; hot water radiators; traffic control signals; ornamental pillars, cast-iron chairs; axle boxes, brake blocks, steel castings, and a model of the "Royal Scot," as Stewarts and Lloyds' pig-iron was largely used in the manufacture of this locomotive.

Two other raw materials for foundries—Lowick ganister and limestone—are also shown. An attractive exhibit is designed to show the flexibility of pig-iron. It consists of three springs machined from pig-iron, which are constantly being submitted to tension and compression. Before the exhibition opened the model had been on show at last year's Cardiff Engineering Exhibition and this year's British Industries Fair, and each spring has been subjected to a quarter of a million reversals without fracture.

A Corner of Stewarts and Lloyds' Stand, showing the Continuous Reversing of Springs cut from Pig-iron.

Oil and Sand Mixer by Spermolin.



Rotary Core-extruding Machine by Spermolin.

TESTING MACHINES

Tensometer, Limited, of 73, Southampton Row, London, W.C.1, who handle the well-known Hounsfield Tensometer testing machines, of which over four hundred are already in use throughout the world, are showing, in addition to their standard types of machine, new models which have recently been developed. These are not only capable of handling ordinary tensile

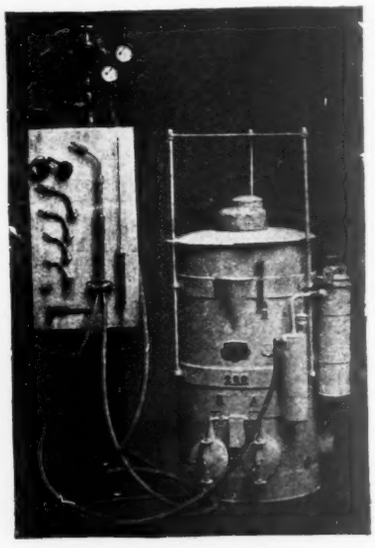
test-pieces of greater length than is the case with the present models, but also of providing for tests of wire, strip, fabric, etc. Although this machine has many new features, it is as easy to manipulate as other models.

Autographic results may be obtained in minimum time by a comparatively unskilled operator, whilst the graphs are much larger than those recorded on previous models. The remarkable accuracy of results, as compared with those obtained on large machines, is maintained. One of the chief advantages is that the same machine can be adapted to carry out not only all the usual tensile tests on steels, non-ferrous metals, etc., but also tests on a variety of other materials, the test-pieces being of considerable length, as, for instance, wire test-pieces up to 14 in. between the grips.

OXY-ACETYLENE WELDING AND CUTTING EQUIPMENT

Messrs. Thorn & Hoddle, Limited, of 151, Victoria Street, London, S.W.1, claim to be pioneers in the development of acetylene generators, blowpipes and all accessories for oxy-acetylene welding, yet an inspection of their exhibit shows no evidence of any intention to rest on their laurels.

The exhibit is principally devoted to low-pressure apparatus for oxy-acetylene welding and



A PORTABLE ACETYLENE GENERATOR WITH OXYGEN CYLINDER SHOWN AS A COMPLETE WELDING UNIT BY THORN & HODDLE.

cutting, under which system acetylene is produced by means of carbide and water direct from a generating plant. This principle is usually adopted where welding and cutting are carried out on any large scale, on account of its low-running cost.

Examples of this type of plant are shown in varying carbide capacities suitable for any class or volume of work. Their pattern K-generator is suitable for foundries where several welding points are installed, main service pipes being carried from the position chosen for the plant to the welders' benches. Where a very large output is required, two or more plants can be coupled together.

Portable generators are also exhibited, and it is claimed that these give all the facilities to be obtained from acetylene in cylinders. A recently-introduced carbide-to-water generator (the "Eveready"), combines extreme portability with ability to cope with a big demand for gas. The weight empty is only 56 lbs., and it is therefore more easily moved than a cylinder, yet it will deliver acetylene to any desired volume up to 60 cub. ft. per hour without overmake.

Messrs. Thorn & Hoddle are also showing most of the accessories necessary for both welding and cutting, including separate blowpipes for either process, and combined welding and cutting sets. Their Weldorcut blowpipe is what might be termed a "general purpose tool," seeing that it can be fitted with welding heads capable of dealing with all thicknesses of metal, and a cutting attachment which quickly converts it into an efficient tool for cutting either mild steel or cast iron.

Three alternative shanks or handles are available, to all of which a full range of welding heads and a cutting head can be fixed. The heads are also supplied in three forms—set at the conventional angle suitable for ordinary welding, set at practically a right angle, which is the most suitable type for rightward welding, and a third type set at the correct angle for low-temperature welding. All these component parts are interchangeable.

All the blowpipes shown embody an improved form of injector which ensures a perfect welding flame under all conditions and eliminates any tendency to backflash. Among these blowpipes is a two-flame type, which effects an economy of about 10 per cent. in the volume of gases consumed, and 33⅓ per cent. in the time taken by the operator. One of the flames is used to raise the temperature of the parent metal to nearly welding point, the actual welding and melting of the filler rod being done by the second flame. This type is of especial value where the "rightward" method of welding is adopted.

Demonstrations of the latest technique, including the low-temperature welding of cast iron by the "Gussolite" process, which is specially adapted to the repair of flaws in castings discovered during machining operations, are given to those interested.

CLEANING OF CASTINGS*

The most interesting exhibit on the stand of *Tilghman's Patent Sand Blast Company, Limited*, of Broadheath, near Manchester, is undoubtedly the Wheelabrator, as developed and perfected by the American Foundry Equipment Company. They have acquired the sole right of manufacture and sale of this machine throughout the British Empire (except Canada). The Wheelabrator is revolutionary in design, in that it requires no compressed air for its operation, the abrasive being centrifugally slung, and the direction of the abrasive is controlled. The cost of cleaning by this method, where applicable, is stated to be approximately one-third that of cleaning by pressure sand blast. The Wheelabrator is to be shown in operation on the stand.

Tilghman's standard types of sand- and shot-blast machinery are to be well represented. A 30-in. by 36-in. tumbling barrel is to be shown working, as is also a 6-ft. by 4-ft. chamber with apparatus and rigid-screen dust arrester. An 8-ft. by 7-ft. sand-blast room, with a 7-ft. diameter hand-operated rotating table, placed half in and half out of one of its sides, is flanked by a standard 9-ft. by 6-ft. room.

A sand- and shot-blast exhibit is completed by a combined sand- or shot-blast apparatus and tumbling barrel, measuring 24 in. by 19 in., and carrying a 3-ft. square chamber, with the dust-arrester combined, and a hand-operated sand-blast machine for the badging and lettering of glassware.

The air compressors shown cover a very wide range. The largest machine, of the double acting, two-stage type, 400 cub. ft. per min. capacity will supply air at 100 lbs. pressure to the various exhibits which are running on the stand.

A complete range of single-acting, single-stage machines, with capacities varying from 4 to 180 cub. ft. per min. and one double-acting, single-stage compressor, delivering 230 cub. ft. per min. are also being shown.

PIG-IRON*

The United Steel Companies, Limited, are exhibiting on behalf of their branch, Workington Iron & Steel Company, and associated company, Appleby-Frodingham Steel Company, Limited. The Workington Iron & Steel Company are showing specimens of Workington and Distington West Coast hematite pig-irons, well known for their "personality" because of the particularly rich and pure Cumberland hematite ore from which they are made. The Workington plant has recently been reorganised and modernised.

The display includes "UCO" all-mine pig-irons, the latest development of West Coast hematite pig-irons. These irons are noted for their low sulphur content, and it is claimed that they ensure castings of quality and reliability however severe the wear and stresses to which they are subjected. Actual products made from Workington and "UCO" irons are also being shown. Appleby-Frodingham Steel Company, Limited, who supply large quantities of plates for shipbuilding, are showing examples of the uses of Appleby plates.

FOUNDRY RAW MATERIALS AND SUNDRIES*

The exhibits of *Messrs. T. W. Ward, Limited*, of Albion Works, Sheffield, are extremely wide, as they cover not only raw materials such as pig-iron, coke and sands, but also a full range of sundries, such as core oils, plumbago and blackings. Because of their numerous works, the firm claims to be able to give a specialised service to the foundry industry. In London and in other large centres, important stocks of Priestman foundry cokes and North-East Coast pig-irons are carried. Samples of these are on the stand, together with various grades of Mansfield moulding sands. Mr. Arnold Carr is in charge of the stand, and with him are to be the following: Mr. Ronald Causebrooke (Silvertown office); Mr. F. A. Shirt (East Yorks); Mr. F. W. Robinson (Lancs and West Yorks); Mr. G. B. Allwood (Derby and North Midlands); Mr. S. Hadfield (Birmingham and Black Country); Mr. A. C. Whitton, and others from Messrs. The Priestman Collieries, Limited.

ELECTRIC FURNACES

A wide range of electric furnaces is shown on the stand of *Wild-Barfield Electric Furnaces, Limited*, of North Road, London, N.7. They vary from small laboratory equipments to large-scale production plant, and are represented by the numerous examples in operation. Whilst there are several entirely new models, many of these hitherto shown embody improvements and modifications which will be of general interest.

The well-known automatic hardening furnaces are represented by a vertical and a horizontal model. These furnaces are equipped with the magnetic indicator, which shows the critical point of carbon, carburised and low-alloy steels. Parts when quenched at this point have the finest possible grain structure and consequently the greatest resistance to wear.

A standard "Heavy-Hairpin" box-type carburising furnace shows the developments in the construction of robust furnaces which are being built in all sizes for many classes of heat-treatment. Some of the largest installations in this country are built on the same lines, in which the "Heavy-Hairpin" elements, with a life second to none, and now measured in terms of years, can, when the time comes, be replaced by the user without delay and at little expense. As such a replacement can be effected whilst the furnace is at working temperature, dislocation of production is eliminated.

A new equipment, in which a smaller "Heavy-Hairpin" furnace forms the preheating chamber of a high-speed steel-hardening equipment, is in operation. The hardening chamber, with a temperature range up to 1,400 deg. C., embodies

various new features. Both chambers are fitted with the latest atmosphere-control devices, which are the simplest available, yet with which, quality hardening is sure. Much of the hitherto somewhat complicated apparatus has been dispensed with, the resulting equipment requiring little manipulation in use.

Another new equipment is found in the rotary-drum furnace. This type, as a type, is not new, but in the past has been usually confined to high outputs, in the order of 5 to 10 cwts. or more per hr. There is a wide scope, however, for a similar type, but suitable for outputs on a smaller scale, and the equipment shown is similar to a large number supplied for annealing brass components. It can be made for bright annealing, hardening, normalising, etc., and, as will be seen, forms a very compact equipment, well suited for placing adjacent to a press or other plant from which the components to be heat-treated are received. Many firms at present using batch-type furnaces will find this equipment of interest.

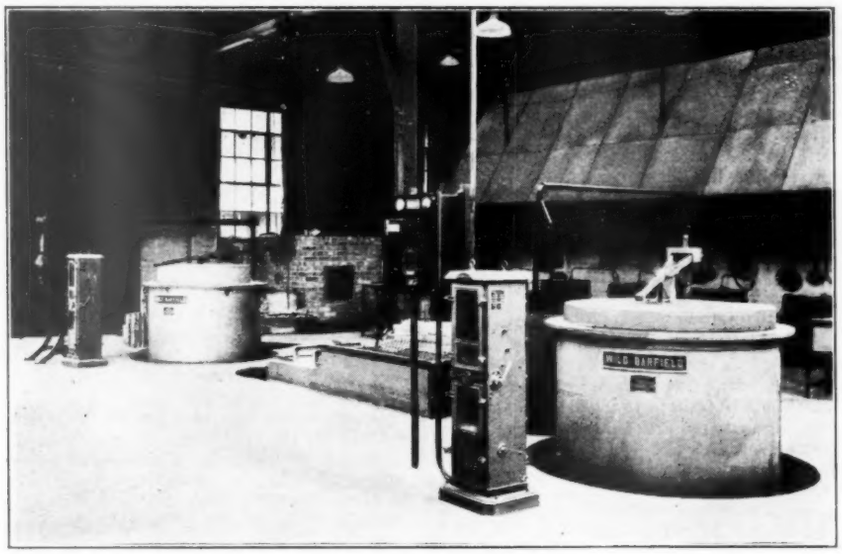
Forced-air-circulation furnaces are an important feature of the exhibit and are of special interest to light-alloy foundries. A production-type furnace, with charge progress recorder, similar to the very large number in use in this country and abroad for tempering, secondary hardening, heat-treating of aluminium alloys, etc., is in operation and available for heat-treating work which visitors may care to bring. The important point to note is that the means for circulating the air is provided by the patent centrifugal fan. It has been proved conclusively by independent tests that this type of fan alone can maintain the high-velocity circulation when the charge consists of densely-packed components. The importance of this point will be realised when it is remembered that the rate of heating and uniformity of temperature are dependent upon this air circulation.

The charge progress recorder which normally forms part of the equipment is of distinct importance. It removes entirely the old uncertainty of whether a charge has reached the desired temperature or not. In this way it enables a batch of work to be removed from the furnace without loss of time, increases the output and forms a permanent record of the treatment given to each charge.

A wide range of works and laboratory furnaces of small sizes is exhibited, whilst photographs of many interesting installations of continuous and other mechanically-operated furnaces will be on view. A Vickers hardness-testing machine, with the new swinging-table device which materially reduces the time taken for testing, is certain to create considerable interest.

FOUNDRY REQUISITES*

The stand of *Thomas Wilkinson & Company, Limited*, of Carlton Blacking Works, Middlesbrough, is mainly devoted to samples of foundry facings and coal dust, including their well-known "Carlton Patent Blacking," which is used for all kinds of high-grade castings, heavy and light. It can be used either wet or dry. They also show a wide range of chaplets, riddles, brushes and core gums. They ship foundry loam and sands to the North of England and Scotland. Mr. Wilson, the newly-appointed general manager, will be in attendance on the stand.



Electric-Furnace Plant with Air Circulation for Heat-treating Light Alloy Castings by Wild-Barfield.

Moulding a Bearing Bracket*

By T. W. Trayherne.

The production of single castings is often a difficult problem, and much depends upon the individual conditions of the foundry concerned in deciding what method shall be employed to produce such castings. The following is an instance showing how such a job was handled. An order was received for a bracket which housed the bottom bearing of a 1,250-h.p. vertical pump motor. It was ascertained that the making of a pattern would be far too expensive.

A segmental corebox was rejected as being neither cheaper nor quicker than loam moulding, and, as skilled loam moulders were available, this method was adopted. Fig. 1 shows two views of the casting, which consists of six stoutly-ribbed arms springing at an angle of 40 deg. from the encasement of a circular oil well. The casing carries external fins for cooling purposes, arranged in pairs between the arms.

From the inner walls of the oil well project twelve ribs, which terminate with stepped blocks machined to hold a Michell thrust block. In the centre, a sleeve takes the shaft extension, to which is coupled the pump. The general thickness is 2 in., with an overall diameter of 7 ft. and a maximum depth of 20 in. The strickle spindles used for "sweeping up" were 3-in. dia., and revolved in a cast plate.

A bottom plate, 102 in. in diameter, was set to a spindle, and the bottom strickle bolted on in the usual way. The outside diameter was then bricked up, and the contour made up with core sand. This was well vented and flat rammed to allow about ½ in. of loam on the surface. After wetting, the mould was swept up and allowed to stiffen. This forms a seating for the six main ribs (A, Fig. 1). After marking out, the ribs were placed in position and secured by lightly ramming with core sand. Two cooling fins (B, Fig. 1) were also set and held by a template block. Fig. 2 shows the ribs set ready for further ramming. The intervening space between two main ribs was then rammed up to the height of the strickle, ashes being placed in the centre for venting purposes.

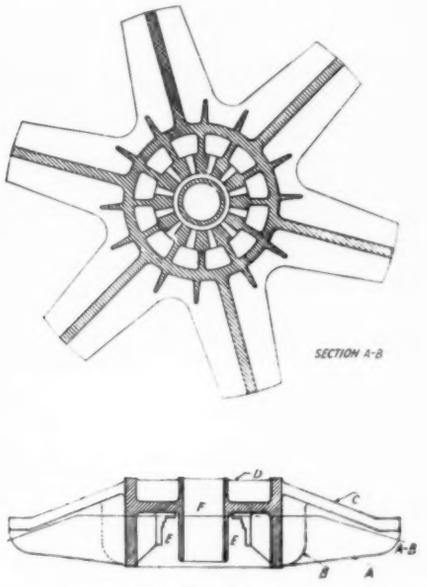


Fig. 1.

The template block was then moved to the next pair of arms, and the process repeated until the whole mould was rammed flush with the strickle. After flat ramming and venting, the mould was re-swept and allowed to stiffen again. Above each main rib an arm was placed, forming the tee section of the casting (C, Fig. 1). Two blocks forming the contour of the arm were then registered above the pairs of ribs by means of dowels, and the space between rammed level with the top of the arm. A thickening piece, corresponding to the depth of the arm, was then taken off the strickle and the segment between the two arms struck up. This was repeated until the six arms had received their shape.

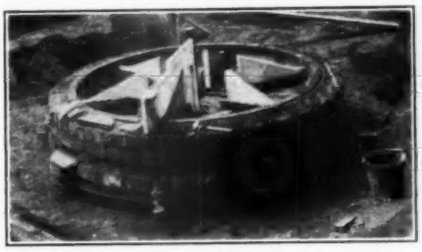


Fig. 2.

The main ribs were then withdrawn, and all the sharp corners given an angle registered from

* An entry to a Short Paper Competition organised by the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen.

a template, thus finishing the bottom part of the mould. Fig. 3 shows the completed bottom half of the mould. A top part was cast with two rows of bars to take the outside brickwork, and "prodders" to support the central ribs.

The outside diameter having been bricked up, core sand was used for the centre portion, but prior to this six small ribs (D, Fig. 1) were set in position, and finally the entire mould was swept up.

Provision was made for eight 1½-in. dia. runners to enter the casting on the oil-well wall, and for four ¾-in. dia. runners on the centre

FIG. 3

sleeve. Three risers were placed on the arms. For the oil-well core, a full box was made (E, Fig. 1). Great care was taken in the venting, both ashes and wax rope being used and provision made for the gases to escape from the bottom of the core. The centre core (F, Fig. 1) was a true cylinder, 7-in. dia., 20 in. in length.

After drying for one night, the top part was turned over and the runner box placed in position. The runners and risers were then made up and the top part again stoved with the rest of the mould. On withdrawal from the stove next morning, the mould was blacked and the oil-well core dropped into its print.

This was screwed down from the underside of the bottom plate. The sleeve core fitted into a print in the oil-well core, and was registered into a corresponding print on the top part. By

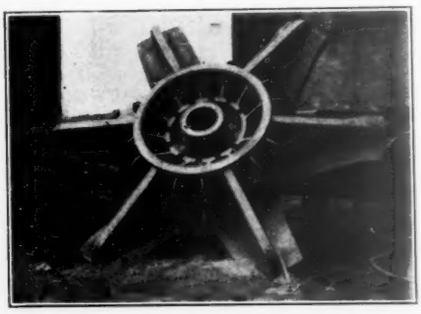


FIG. 4.

means of a finger guide and four centre lines, the top part was lowered into position, and weighted with 10 tons in the form of blocks. All the runners had plugs, the sleeve ones being withdrawn 30 sec. after those on the oil-well wall. The total casting time was something less than 1 min.

After cooling for three days, the casting was dressed, and the centre part pickled to remove all traces of sand and scale. The weight of the finished casting as it left the foundry was 4 tons 5½ cwts. (Fig. 4). Machining allowances were made on the thrust-block pads, the whole of the centre sleeve and the underside of the arms. A hot-oil pressure test was given to the centre portion, and it was found to be satisfactory.

Silver in the Foundry

BY E. A. SMITH, A.R.S.M.

While silver is not a metal that is usually associated with foundry practice, nevertheless a perusal of its history shows that from time to time it has been used for the production of art castings that are by no means inconsiderable in size and weight when the intrinsic value of the metal is taken into consideration, although small when compared with the historic castings in bronze.

The fact that silver is a metal of remarkable malleability and ductility has from very early times led to its use for the production of all classes of wrought work, since it lends itself with great facility to the designs of the artist and the craftsman. Consequently most of the ancient silver work that has come down to us is wrought work that has been skilfully hammered into the desired form in the hands of clever craftsmen, and is not cast work.

This is equally true and characteristic of modern silversmiths' work. In fact, the art of fashioning silver into graceful forms for ornament and household use is one of the oldest expressions of the love of the beautiful. From the earliest times silver, on account of its natural beauty, and comparative rarity, seems to have been marked out as an appropriate material for the production of all articles, whether of utility or ornament, that are especially devoted to the service of magnificence and splendour.

All the numerous silver objects found in recent years at Ur of the Chaldeas, which date back to some 3,500 years before the Christian era, are wrought work of exquisite craftsmanship. Also, the wonderful collection of silver vessels found some years ago on the ancient site of Troy and at Mycenae consists almost entirely of wrought work. One notable exception is the famous ox-head, about 9 in. high, which is a hollow casting in one piece, whilst the horns are shaped out of gold plate and fastened on. The date assigned to this unique object is about 2500 B.C.

Silver casting for artistic purposes was practised at a very early date, the earliest known specimens being undoubtedly cast by the waste-wax method, the antiquity of which was referred to in our issue of August 1 last. In tracing the history of silver casting, it must not be overlooked that the founders in the metal had most probably acquired previous experience and skill in the casting of copper and bronze objects, the casting of which metals had been practised from the most remote times.

Regarding our own country the Anglo-Saxon preference for broad effects and lavish ornament is well displayed in some of the beautiful large cast silver brooches that have been discovered and are exhibited in the British and other museums. In the Middle Ages and in later times cast parts on silversmiths' work became more frequent, but few of these can be described as very large castings. More often than not they consisted of handles and feet and decorative mounts or parts attached to large pieces of wrought work. Any large castings that were made were no doubt in due course consigned to the melting pot.

Silver when pure is by no means an easy metal to cast to get castings that are perfectly sound and free from sponginess. In the molten state it has the very interesting and unique property of absorbing large quantities of oxygen; and just above its melting point of 961 deg. C., will absorb as much as twenty times its own volume of this gas. Practically all the oxygen is liberated during the subsequent solidification of the metal, resulting in a "spit" which covers the whole of the exposed surface of the bar cast in an open mould. The effect of this on the silver is to cause sponginess and a certain amount of brittleness which renders pure silver in the cast state useless for industrial purposes unless proper precautions are taken to remove the oxygen before casting the metal.

In modern silver foundry practice this is usually overcome both in the case of pure silver and the alloyed metal by the use of deoxidants, such as cadmium, zinc, or phosphide of copper. Art silver castings are usually made with alloyed metal, most frequently copper, the presence of another metal helping to remove the absorbed oxygen and give sound castings. In Great Britain the ordinary Sterling silver, containing 92.5 per cent. of silver and 7.5 per cent. of copper or other metal, is most frequently used, whilst a 90 per cent. silver alloy is more general in America and on the Continent.

To obtain sound castings close attention has to be given to the melting and teeming temperatures, and overheating avoided, to prevent a spongy cast; and it is essential that the molten metal should be protected from oxidation by a suitable covering of charcoal or of borax or other flux, which is skimmed off before casting.

With the more active development of silvercraft, especially during the Victorian period, art casting began to be more generally practised but a large proportion of this work consisted of knobs, feet and spouts of tea-pots, etc., and small figures for attaching to racing cups and trophies of all descriptions.

Even these small castings are gradually being replaced in modern practice by stamped parts made from thick wire or rod shaped in a stamp or press. Occasionally a casting of exceptional weight is called for, and these are usually cast in the usual way in sand moulds, or in special cases by the waste-wax method. Work that is undercut or in any way complicated can only be cast by piece-moulding or by the waste-wax method. Of necessity castings of any considerable size are made hollow, and the thickness may be less than ⅛ in.

Large castings made of silver in recent times include quite a variety of subjects. One of the earliest developments of silver casting was undoubtedly for the images and idols so frequently mentioned in the ancient Hebrew records and in some cases were of considerable size. Cast-silver statuettes of gods and of animals, recovered from the underground repositories where they had lain ever since the Greek and Roman periods, can be found in most national museums. Moreover, the casting of statuettes in silver, both solid and hollow, is still an important branch of silver founding. Silver statuettes are not infrequently exhibited at the Royal Academy, many of which are not only beautiful works of art, but display considerable skill in casting.

What, however, appear to be the largest figure castings in silver so far made in this country were four nude female figures that formed the bedposts of a large silver bedstead made some years ago by a Sheffield firm for an Eastern potentate. These beautiful figures were of solid sterling silver and about 3 ft. high, and were very skilfully modelled and cast. Other silver castings include bells. The exquisite tone of a silver bell has long been the subject of remark, and in the past the bell sounded at the Mass used often to be of silver. It is not often that bells of large size have been cast in the metal. The largest silver bell that has even been cast was a full-sized ship's bell, made in 1928 for a Newcastle firm of silversmiths, by Messrs. J. Stone & Company, the London founders, for H.M. Battleship "Nelson." This bell, of unprecedented size, was made of solid silver and of magnificent workmanship, and weighed over a hundredweight. It was the gift of the residents of Tyneside to the "Nelson" to commemorate the fact of her being built on the Tyne. These few examples are sufficient to show that silver in the foundry is not entirely confined to very small objects, but lends itself with equal facility to the production of large objects of great beauty when modelled by a true artist and cast by a craftsman who is thoroughly conversant with the metal's characteristics and peculiarities.

A Modern High-Output Steel Foundry

THE WORKS OF KRYN AND LAHY

Whilst numerous reasons are assigned for the growth of industry in the South of England, the establishment of Kryn and Lahy was due to the desire to give useful employment to the Belgian refugees who had settled at Letchworth during the war. The original idea was to manufacture shells, but it was soon realised that acid converter steel is unrivalled when made under strictly controlled conditions.

The works are pleasantly situated on the outskirts of Letchworth Garden City, where, of a 26-acre site, nine are under roof. From the general plant lay-out shown in Fig. 1, it will be seen that reliance is placed upon overhead cranes as the major medium for internal transport. There are no less than 17 cranes, ranging from 15-ton electric overhead travellers, down to 30-cwt. jib cranes of which half-a-dozen are installed. This transport is supplemented by numerous lengths of narrow-gauge tracks carrying wheeled tubs. Production is at the rate of 150 to 200 tons of finished castings per week and the number of operatives on the works payroll is about 750. It will be seen from Fig. 1 that the area of the moulding floor is about 40,000 sq. ft., so that the production is about 2 lbs. per sq. ft. per diem. To attain the fullest use of the moulding floor, a special siding has been brought into the foundry, and all boxes not in immediate use are stocked in the open air.

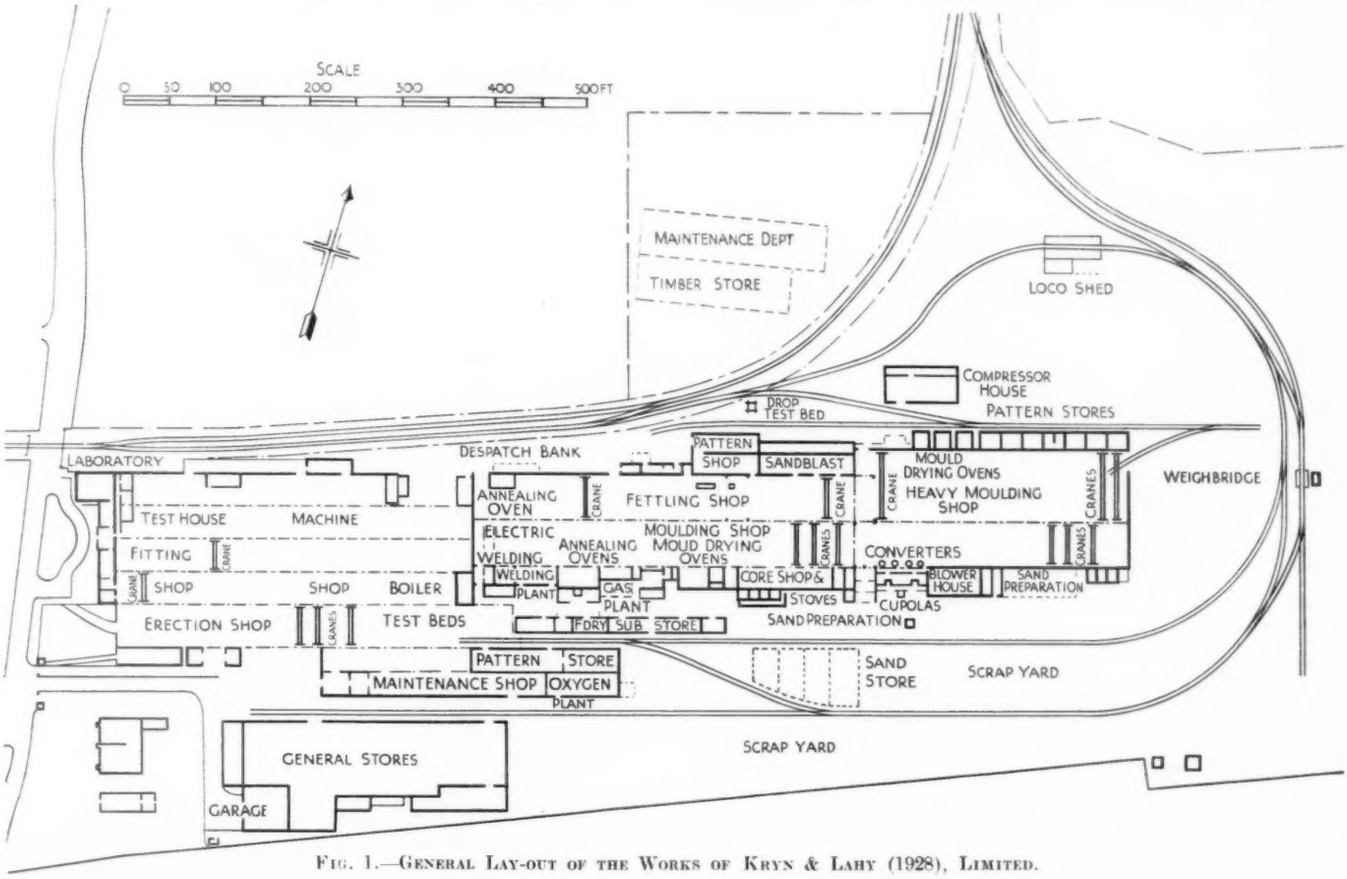


FIG. 1.—GENERAL LAY-OUT OF THE WORKS OF KRYN & LAHY (1928), LIMITED.

Raw Materials

The principal raw material used is that of selected steel scrap, such as old rails and other material low in sulphur and phosphorus together with returned runners and risers from the foundry. Obviously, this scrap requires to be cut up before charging into the cupola, and for this purpose the fractional distillation oxygen plant has been installed. It manufactures 100,000 cubic feet of 99 per cent. purity gas per week. In this connection, it is interesting to note that the purity of the oxygen has a profound effect upon the tonnage of scrap cut per unit of gas used. An illustration of this plant is shown in Fig. 2. Acetylene gas is also generated and is piped to the various points of consumption. This installation is shown in Fig. 3. The other major raw material is 4 to 5 per cent. silicon hematite iron.

Melting Plant

The raw materials are taken to the cupola stage by lift and are hand-charged. There are two cupolas of 6 to 7 tons per hour melting capacity, which are operated according to the Poumay system. It will be remembered that the fundamental principle underlying this process is the burning of the carbon monoxide which is generated in the melting zone by air introduced through auxiliary spirally-disposed tuyeres. The cupolas are 6 ft. 6 in. outside diameter lined down to give 45 in. internally. The plant, which is illustrated in Fig. 4, is blown by centrifugal fans direct coupled to variable-speed motors. For the repair of the

amongst the many employees there was a considerable number of highly-skilled moulders. Thus by the end of 1916, both the surface blown converter and electric processes were well established and the foundry has now become one of the largest in Great Britain. During the passage of a couple of decades, the management has arrived at the conclusion that as a raw material, for the manufacture of castings,

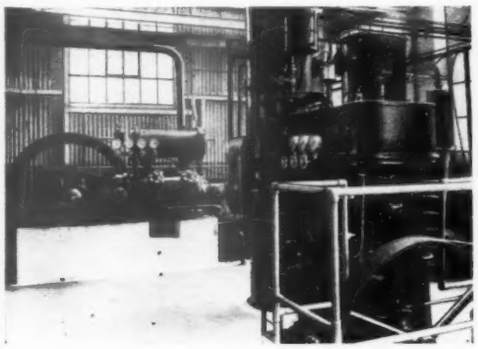


FIG. 2.—OXYGEN-GENERATING PLANT.

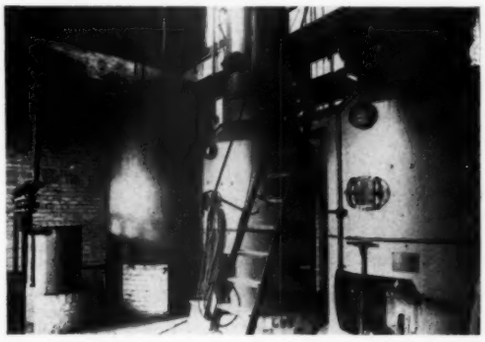


FIG. 3.—ACETYLENE-GENERATING PLANT.

cupola, 56 lbs. of Sheffield Ganister is used per ton of metal throughput. This performance is particularly good considering the heavy nature of the charge and the high percentage of steel used. The melting coke consumption is of the order of 12 per cent. Lower figures can and have been obtained, but as the desulphurising process, which follows, demands high initial temperature metal, the sacrifice of a little extra coke has been found to be well worth while. For the desulphurising process, 1 per cent. by weight of soda ash is used. It is placed at the bottom of a well-heated neutrally-lined ladle, the temperature being such that the soda ash is in the pasty condition. A violent reaction occurs which not only reduces the sulphur by something of the order of 50 per cent. but cleans the metal through the mechanical action of the carbon dioxide gas bubbling through it. The desulphurised metal is poured into one of the four converter-vessels which are blown at approximately 2 lbs. pressure. The metallic losses are unquestionably low, and are of the order of 12 as against the 18 per cent. normally encountered. The control which is exercised throughout the complete process, is designed to yield exceptionally clean steel. Table I shows the chemical composition and mechanical tests of the steel produced, together with figures showing the influences exerted by the desulphurising process.

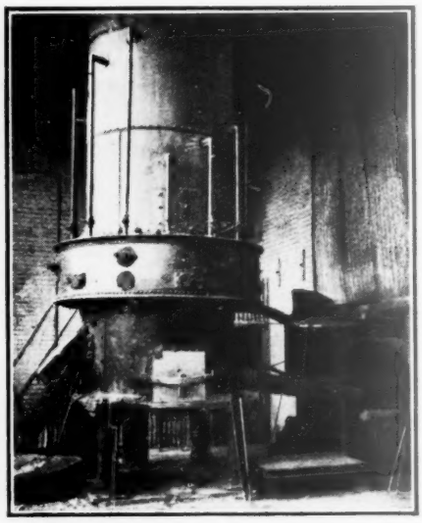


FIG. 4.—ONE OF THE "POUMAY" CUPOLAS INSTALLED, SHOWING AUXILIARY TUYERES.

FIG. 6.—GENERAL VIEW OF THE HEAVY BAY.

Casting Practice

All metal is cast from bottom pouring ladles, using a graphite stopper end and fireclay nozzle. The ladles are dried by inverting them over cylindrical steel castings filled with coke, arrangements being incorporated for the introduction of a compressed air line. The castings are treated by the Follsain process in order to assure an increased life. The arrangement is shown in Fig. 7.

Sand Practice

Most of the castings are knocked out on the site and the sand is conveyed by tubs and tipped over one of two gratings. Above the operator's head is an exhaust arrangement to ensure that no dust is inhaled. The gaggers are retained on the grating and are returned to stock. The sand falls on to the boot of a bucket elevator, which takes it to an upper storey. Here it empties into a cyclone, much of the same type as one associates with sand blasts, and the fine silt is removed and evacuated to the extent of 7 to 10 per cent. by weight in the atmosphere. The sand is then milled in a 7-ft. pan, which feeds a Herbert disintegrator. The disintegrated sand is fed into a storage hopper, the bottom of which terminates in a shoot with a clamp shell closure at 4 ft. from the ground level. This is of convenient height for filling tubs for easy transport to the moulds. In general, synthetic sand is used, reinforced by a modicum of Belgian material, about 50 per cent. old sand being incorporated with the mixture. The sand for general purposes is controlled to yield 15-lb. compression strength and 20-second permeability,

FIG. 5.—POURING MOULDS IN THE MEDIUM BAY, SHOWING THE STEEL-MAKING PLANT AND LIGHT MOULDING BAY IN BACKGROUND.

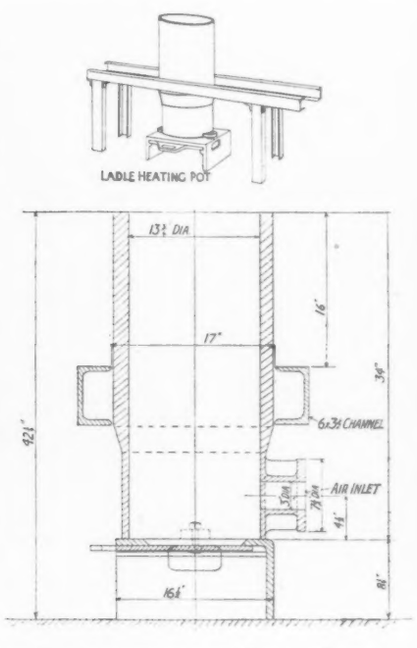


FIG. 7.—ARRANGEMENT FOR DRYING LADLES (UPPER) AND DETAILS OF THE STEEL CASTING USED FOR THIS PURPOSE (LOWER).

both measured on standard B.C.I.R.A. instruments, but the plant is capable of producing sands of different characteristics when required for special purposes. The moisture content, which is measured by a Speedy tester, is controlled at 4.5 to 5 per cent. In addition, a mould-hardness tester—something of the nature of a Brinell machine—has been used with satisfactory results. All moulds are dried, and whilst much of the production is made by hand ramming, there are available 16 plain jar ramming machines of the Macdonald, Mumford and Zimmermann types. In order to avoid heavily flashed or cross jointed castings, the box parts are set by male and female hemispheres, incorporated in the upper and lower parts. A sketch of this system is shown in Fig. 9. With few exceptions, most of the cores are made from the same material as the moulds, but some of the lighter ones are made from oil-sand mixtures.

TABLE I.—*Typical Analyses of Cupola Metal and Results of Physical Tests on Mild Steel and K.L. Stronger Steel.*

Typical analysis of cupola metal.	Before desulphurising.	After desulphurising.
	Per cent.	Per cent.
Total carbon ..	3.2	3.1
Manganese ..	0.5	0.5
Silicon	1.5	1.3
Sulphur ..	0.09	0.049
Phosphorus ..	0.050	0.051

	After standard annealing.		
	Tensile strength.	Elong.	Cold bend test.
Mild Steel Chemical analysis— Per cent.			
Carbon .. 0.14	28/30 tons per sq. in.	33/39 per cent.	180 deg. without fracture
Manganese 0.75			
Silicon .. 0.303			
Sulphur .. 0.049			
Phosphorus 0.056			
K.L. Stronger Steel Chemical analysis			
Carbon .. 0.32	35/40 tons per sq. in.	20/25 per cent.	120 deg. minimum without fracture
Manganese 0.88			
Silicon .. 0.350			
Sulphur .. 0.049			
Phosphorus 0.056			

Mould Drying

The mould-drying methods have previously been dealt with in our columns* and it is only necessary to state here that there are now in use six ovens of the Herrmann type of from 2,500 to 4,000 cubic feet capacity. This system, it will be remembered, is based upon the extremely rapid combustion of low-grade fuel which, on account of speed reduces heat losses to a minimum. The heat so generated is stored in a mass of chequered brickwork, and after a comparatively short period, the fire is closed down and air filters slowly through the heated brickwork to dry the contents of the stove. Since the time of the detailed description of this plant, the furnace doors have been well insulated and thermo-electric pyrometers have been put into service. In addition, there are six smaller stoves which are also coke fired and are used for core drying.

Fettling

The shops of Kryn & Lahy have provided special facilities for the manufacture of locomotive wheel centres, and in this connection there has been installed, in the foundry itself, a special machine by Clifton & Baird for parting off the very heavy centrally-disposed bosses. Other risers are removed by oxygen cutting. There are four high-speed swing grinders and four stationary ones, using Bakelite-bonded wheels. It is interesting to note, in this connection, that too high speeds are prevented by a control based upon a standard distance of the guard from the wheel. As the wheel diminishes in diameter, so the speed is increased automatically by the lowering of its guard. Other fettling facilities include a sand-blast chamber operating at 30 lbs. pressure and large numbers of pneumatic chisels. A well-equipped patternshop, replete with the usual equipment, is available for both the making of new patterns and the alteration and repair of used ones. The compressed air used throughout the foundry is supplied by Browett Lindley compressors, of which five are installed, with an output capacity ranging from 250 to 1,500 cub. ft. per min. The largest one of these is shown in Fig. 10.

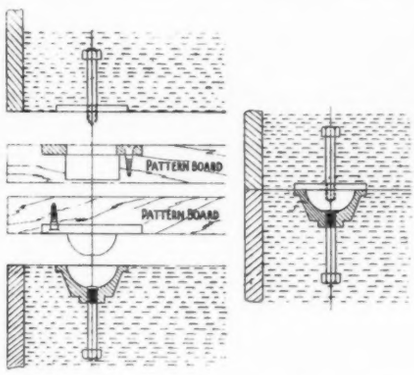


FIG. 9.—SKETCH SHOWING METHOD OF SETTING MOULDS.

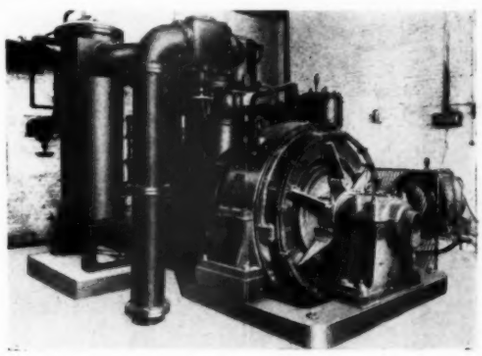


FIG. 10.—BROWETT-LINDLEY 1,500 CUB. FT. MACHINE IN COMPRESSOR HOUSE.

Heat-Treatment

This department has recently been reorganised and a pulverised-fuel system of firing has recently been installed by the Buell Company. Each of the stoves will carry about 20 tons of castings, and is equipped with self-recording pyrometers which indicate not only at the furnace for the operators, but also record in the laboratory for control by the chief chemist. A permanent record of each anneal is thus obtained, and related to each heat-melting number. There is one central grinding plant for the furnaces, each of which is furnished with four burners. The flames impinge on a baffle wall, carrying a flue; air drawn through this flue is heated to about 200 deg. C., and is used for carrying the powdered fuel to the burners, to the extent of 10 per cent. At the burner additional cold secondary air is introduced to effect combustion.

Type of Output

The steel castings made range in weight from a few pounds to eight tons, and normally about 80 per cent. are subject to inspection and survey by the representatives of the National Buying authorities, such as the government departments and the railway companies. Turbo-casings, mining machinery, bed plates and ship's davits are regularly produced. The last-named is a particularly difficult casting to make, being long and thin and curved. As a result of long experience, however, something near perfection has been achieved.

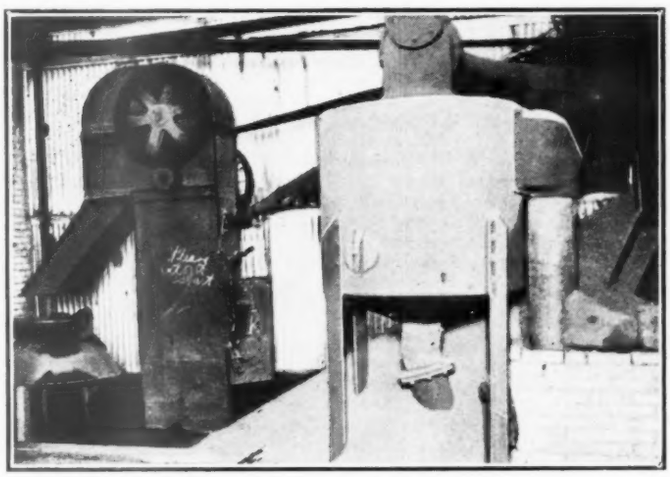


FIG. 8.—VIEW IN THE SAND-PREPARING DEPARTMENT.

FIG. 11.—TEST HOUSE.

Test-House and Laboratories

Every cast of steel and many individual castings are separately analysed and tested for

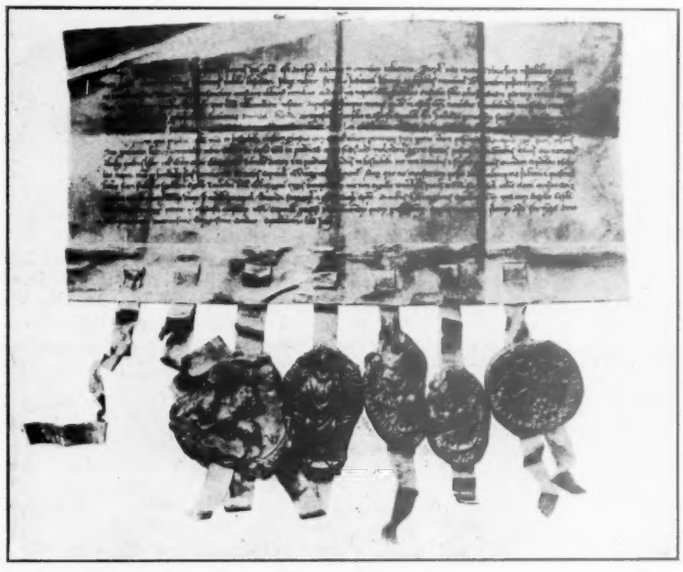
(*Concluded on page* 198.)

* FOUNDRY TRADE JOURNAL, Vol. 43, p. 214.

A Share Transfer of A.D. 1288

The oldest share certificate extant in the world is to be seen in the museum of the Stora Kopparbergs Bergslags Aktiebolag (the Great Copper Mountain Mining Company) at Falun in Sweden. It is dated June 16, 1288, and is the transfer of one-eighth of the copper mine to the Bishop of Västeras, Peter Elofsson, by his nephew Nils Kristensson. The transfer is sealed with the official seals of Magnus I, King of Sweden, and the seals of the Archbishop of Upsala, the Bishops of Linköping, Strängnäa and Abo, as well as with the seal of Peter Elofsson and that of the chapter of Västeras.

This ancient company was founded some time very early in the 13th century, and the date now given by historians is believed to be about A.D. 1225. At some time in those distant days the shepherds tending their flocks in the valleys of Dalecarlia noticed that the fleeces of their sheep, when pastured in a certain valley of the parish of Torsang, grew with added luxuriance and with a curious bright tinge. Examination by the mediæval alchemists showed that the soil was heavily impregnated with copper, and it was then discovered that the surrounding mountain was chiefly composed of copper. The neighbouring landowners formed themselves into an association and decided to work the mountain and obtain the copper ore. Thus came into existence a company which has existed for seven hundred years, and though to-day the copper is no longer workable, is still the largest industrial concern in Sweden. Up to 1900, when the copper workings were abandoned, it is estimated that 35 million tons of copper ore had been excavated from the mountain.



REPRODUCTION OF SHARE CERTIFICATE DATED 1288.

Within a century of its foundation the company had become a very important factor in the economic life of Sweden, and had earned the special gratitude and protection of her kings. In 1347 King Magnus Eriksson granted the first charter to the company, and in it refers to the "privileges and ancient letters which you had from our parents that had got lost through the neglect of men."

Later in Swedish history we find Kopparberget, as it was generally called, the principal industrial mainstay of the kingdom, and Gustavus Adolphus II gave it the honorary title of "The Country's Treasury." It was with the wealth of this mine that the kings of Sweden in the 17th century were able to fight their wars on the Continent of Europe, for the mine not only provided copper but also gold and silver. With the iron products of the Dannemora mines —to-day the property of Kopparberget—and the wealth of Falun, Gustavus Adolphus and Charles XII were able to carry on those wars in Northern, Central and Eastern Europe which made the name of Sweden famous and feared.

Instead of copper, the mine to-day produces annually 35,000 tons of iron pyrites, lead and zinc ores, from which highly-important materials are recovered for use in the paper, pulp and chemical industries controlled by the company.

The many interests of the company to-day are principally centred in the timber and iron industries. As the largest company in Sweden in the 17th century, it took over the Vintjärn iron-ore mines which had just then been discovered. These, together with the Dannemora mines, also owned to-day by the same company, supplied the armies of Sweden with their weapons. In conjunction with the Vintjärn mines no less than 200 smaller mines are worked. To deal with the produce of these, a huge steelworks has been erected at Domnarfvet, where the whole of the iron and steel output is concentrated. The Dannemora mines, which produce some of the richest iron ore in the world, exports 80 per cent. of its steel and iron products to all parts of the world. Here a new process has been introduced by which steel is made direct from the iron ore without going through the preliminary process of being turned into pig-iron. This is accomplished by the high-frequency electric process. Electricity is cheaper in Sweden than anywhere else in the world, and the company own hydro-electric water-power resources totalling 200,000 h.p.

In the olden days to obtain the copper from the mountain the primitive method of lighting enormous fires in holes and clefts of the mountain was used. As small cracks appeared in the rocks water was poured in and the rock cracked off, the ore then being smelted over charcoal fires. To ensure that the company should always hold adequate supplies of timber for these purposes, the old kings of Sweden granted the company extensive rights over forests in Dalecarlia. During intervening centuries these rights have been consolidated and to-day the company owns timber rights over 850,000 acres of producing forests. An enormous industry has developed out of the property, as may be judged from the fact that the ports of Skutskär and Harnäs, both of which are owned by the company, export every year 55,000 tons of newsprint, 25,000 tons of sulphite pulp, 25,000 tons of soda pulp and 40,000 standards of sawn timber and woodwork.

Founded as the result of the observation of some long-forgotten shepherds the Stora Kopparberg Company, after being the mainstay of imperialistic Sweden, is to-day one of the principal supports of economic Sweden, the largest industrial concern in the country.

A Modern High-Output Steel Foundry

(*Concluded from page* 197.)

tensile, bend and Izod impact. Views of the departments concerned with control and inspection are shown in Figs. 11 and 12. From these it will be seen that equipment is both ample and modern.

Iron Foundry

An iron foundry is maintained for making castings for consumption by their own engineering department and by their associated companies, such as J. Browett Lindley (1931), Limited. About 50 tons are made each month, and this supply is augmented by outside purchases. A new Herrmann mould-drying stove is in course of construction for this section.

FIG. 12.—THE CHEMICAL LABORATORY.

Welfare

Considerable attention is paid to the welfare of the operatives. Its activities embrace a canteen capable of seating 600, a full ambulance service; whilst the sports club caters for football, cricket, bowls, tennis and badminton.

Conclusion

The castings made by this concern exhibit—as is shown in Table I—extremely good mechanical properties; a very serious and continued effort is made to create internally clean and sound castings, and the sand control certainly yields an excellent skin, which unquestionably keeps fettling costs at a minimum. The author desires to express his indebtedness to Mr. J. Deschamps, the joint managing director, for the help accorded to him in the preparation of this article and for the many courtesies shown to him during a long period of years.

FURTHER EXTENSIONS, costing £1,450,000, are to be made to electrical power plants in the provinces. The Central Electricity Board has directed the Liverpool, Norwich and Portsmouth Corporations to instal new generators to meet the increasing demand for power supplies. The extensions are :—Liverpool, 50,000-kw. generator and three 200,000-lb. boilers, costing £750,000; Norwich, 30,000-kw. generator and four 120,000-lb. boilers, costing £400,000; Portsmouth, 30,000-kw. generator and two 120,000-lb. boilers, costing £300,000.

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This Week's News in Brief

Trade Talk

THE SHEFFIELD METALLURGICAL LABORATORIES have removed to 81, Eyre Street, Sheffield, 1.

RENFREW DEAN OF GUILD COURT have approved plans for the erection of a new pattern store for the Carntyne Steel Castings Company, Limited.

MESSRS. ALEXANDER FINDLAY & COMPANY, LIMITED, Parkneuk Bridge Works, Motherwell, will supply five hangars for one of the Air Ministry's air stations in Yorkshire. The work will keep the employees busy for six months.

THE FUNDS AND MEMBERSHIP of the Ironfounding Workers' Association have increased during the past six months. The funds have been augmented by £2,160, and now total £22,246. The total membership is 9,274, an increase of 104.

THE BUSINESS OF Messrs. John Deas & Company, engineers and ironfounders, 67, Sidney Street and 28, East Market Street, Glasgow, E.1, has been acquired by Mr. John Deas, jun., and Mr. H. Gordon Deas. They will carry on the business under the same name, and both persons will continue as joint managers of the company.

THE RAND WATER BOARD has ordered from the Harland Engineering Company, Limited, Alloa, for the Zwartkopjes pumping station of the Leeuwport water supply two high-efficiency centrifugal pumps, one of a daily capacity of 14,000,000 gallons, the other of 12,000,000 gallons, for delivering drinking water against a total head of 1,150 feet.

THE KELVIN CONSTRUCTION COMPANY, LIMITED, Maryhill, Glasgow, have received a contract for the construction and erection of all the workshops and flight sheds for a large aeroplane factory in the Midlands. Several hundred men will be employed for the next six months making the materials in Glasgow, and the firm will then send its own men to erect the buildings.

THE RAND (SOUTH AFRICA) WATER BOARD have placed orders to the value of £530,246 for electrical equipment and tubes and pipes with British manufacturers. Half of the pipe contract, which amounts to £371,108, has been placed with the South Durham Steel & Iron Company, Limited, and the balance with Messrs. Stewarts and Lloyds, Limited, of the British Mannesmann Tube Company, Limited.

AN IMPORTANT CONTRACT in connection with the scientific apparatus on the new liner "Queen Mary" has been placed with Kelvin, Bottomley & Baird, Limited, the well-known manufacturers of navigational and engineering instruments at Glasgow. The contract is for a complete set of Kelvin compasses, pneumercator tank gauges, and other instruments. The outfit is described as the most complete and extensive ever fitted on a British merchant ship. Messrs. Kelvin, Bottomley & Baird also manufactured instruments for the French liner "Normandie."

THE SYLLABUS of the Chelsea Polytechnic in Manresa Road, London, S.W.3, contains details of junior and senior courses in industrial metallurgy designed, respectively, for boys engaged in the light engineering and metal trades, and for technical representatives and salesmen in engineering firms. The School of Metallurgy also has two special courses in (*a*) fuels and refractory materials and (*b*) electro-metallurgy There is, in addition, a two-year course in engineering metallurgy arranged, primarily, for those studying for the examinations of the engineering institutions and other professional associations.

DEFENDANTS IN A CASE at the Bolton Borough Court, on Tuesday, were 22 plate moulders who left work without permission on August 21, the reason being the excessive heat. They were summoned by their employers, Messrs. Crumblehulme, Limited, Derby Ironworks, Bolton, for breach of contract and damages under the provisions of the Employers' and Workmen's Act, 1875. Mr. A. S. Furniss, representing the National Union of Stove Grate and General Metal Workers of England, contested the proceedings. Before Mr. A. Lawson, appearing for the firm, had completed the presentation of his case, consultations resulted in an amicable settlement.

AS WE CLOSE FOR PRESS we learn that the Ford Motor Company, Limited, Dagenham, Essex, have taken a stand in the Foundry Trades Exhibition at Olympia, and are showing groups of representative castings made from Ford pig-iron and also several samples of Ford pig-iron. The firm show in an interesting way the universal application of Ford pig-irons and the advantages of machine-cast pig of a guaranteed analysis, and also to a size convenient for cupola charging. Research has convinced Messrs. Ford that this is the only sound method of producing pig-iron for foundry purposes, and it is their desire to demonstrate to the foundryman that good castings are assured when made from machine-cast pig-iron of close analytical limits irrespective of fracture.

THE IRISH FREE STATE GOVERNMENT has imposed a Customs duty of 60 per cent. *ad valorem* with a 40 per cent. preferential rate on imported vitreous-enamelled hollow-ware of wrought iron or wrought steel, with the exception of fixture baths for bathrooms. A licensing provision is included in the duty. In connection with the promulgation of this new order, it is officially announced in Dublin that the goods mentioned will be produced at a new factory to be opened shortly at Tralee, County Kerry. Imports of enamelled wrought hollow-ware into the Free State for the first seven months of this year reached a value of £34,085, as compared with £27,728 for the corresponding months last year. For the month of July alone the figure was £5,512, compared with £4,137.

Contracts Open

Glastonbury, September 14.—2,000 yds. of C.I. spun pipes, with Stanton Wilson or other approved joints, for the Gas Department. Mr. D. E. Garlick, manager and secretary.

Uttoxeter, September 18.—572 yds. of 3-in. cast-iron mains, for the Rural District Council. Mr. C. E. Ingham, surveyor, Council Offices, Northgate, Uttoxeter, Staffs. (Fee £1 1s., returnable.)

South Africa, September 25.—Cast-iron pipes, special castings, valves, etc., for the Bellville (Cape Province) Village Management Board. The Department of Overseas Trade. (Reference T.Y. 5,233.)

Ardsley, September 16.—Cast-iron water mains, fittings, valves, etc., for the Ardsley East and West Urban District Council. Mr. F. A. Brown, Council Offices, Blackgates, Tingley, near Wakefield.

Singapore, November 4.—Malleable iron pipe fittings and miscellaneous special fittings, for the Singapore Municipal Water Department. The Department of Overseas Trade. (Reference T.Y. 5,237.)

Oundle, September 20.—2,700 yds. of 8-in. dia. cast-iron or spun-iron water main, for the Oundle and Thrapston Rural District Council. Messrs. Pick, Everard, Keay & Gimson, 6, Millstone Lane, Leicester. (Fee £2 2s., returnable.)

East Dean, September 25.—2¾ miles of spun-iron pipe mains from 3 to 9 in. dia., for the Rural District Council. Mr. W. E. Blizard (Messrs. Lemon & Blizard), engineer, 25, Victoria Street, Westminster. (Fee £3 3s., returnable.)

Buenos Aires, September 20.—Pneumatic tools, including rivet holders, hammers for chipping etc., drilling machines, portable grinding machines and rivet-cutting machines, for the Argentine State Railways Administration. (Reference T.Y. 5,202.)

Newport (I.W.), September 23.—1,900 yds. of 15-in. dia. spun-iron pipes and 220 yds. of 15-in. dia. steel pipes, for the Town Council. Messrs. Sandford Fawcett & Partners, 53, Victoria Street, Westminster, S.W.1. (Fee £5 5s., returnable.)

Belfast, September 23.—Electrically-driven centrifugal pump, to deliver 6,000 galls. per min., together with switchgear, piping, valves, etc., for the Town Council. The City Surveyor's Department (Engineering Section), Room 94, City Hall, Belfast. (Fee £1 1s., returnable.)

Buenos Aires, September 26.—Two steam "Duplex" injection pumps, approx. 14 in. by 7½ in. by 18 in., for a working pressure of 126 atms. (1,800 lbs. per sq. in.) and a steam pressure of 18 atms. (250 lbs. per sq. in.), for the Argentine State Oilfields Directorate.

Stockton Brook, September 18.—Seven miles of 15-in., 12-in., 9-in. and 6-in. dia. cast-iron pipe sewers, and two small pumping stations, for the Leek Rural District Council. Messrs. Willcox, Raikes & Marshall, 33, Great Charles Street, Birmingham. (Fee £5 5s., returnable.)

Personal

MR. C. D. POLLARD has joined the staff of Qualcast, Limited, of Derby, where a new steel foundry has been created.

MR. J. G. PEARCE, M.Sc., M.I.E.E., director and secretary of the British Cast Iron Research Association, was married last Saturday, at Chelsea, to Miss May Isabel Wallace, M.B., Ch.B., D.P.M.

MR. J. S. GLEN PRIMROSE (A.R.T.C., Glasgow) has removed to Birmingham, where he was recently appointed to take charge of the metallurgical department of the Rover Company, Limited, at their Hay Hall Road works in Tyseley.

MR. A. E. RHOADES, foundry expert to the Detroit Electric Furnace Company, U.S.A., is visiting England in the very near future, and his advice will be available to the British foundry industry through Birmingham Electric Furnaces, Limited. No doubt Mr. Rhoades will spend a portion of his time on the Birlec stand at Olympia.

DR. WILLIAM S. CORMACK, principal teacher of engineering and technical subjects in Falkirk Technical School, has been appointed Principal of Stow College, Glasgow. Dr. Cormack was educated at Glasgow, graduating B.Sc. and Ph.D. at the University, while he holds the Diploma in Engineering Science gained at the Royal Technical College.

MR. A. N. MCQUISTAN, director and general manager of the Cargo Fleet Iron Company, Limited, and the South Durham Steel & Iron Company, Limited, sailed in the "Empress of Britain" on Saturday last for a prolonged tour of the United States. He is accompanied by Mr. Isaac Williams, chief engineer. Prior to his departure Mr. McQuistan revealed that in addition to the important developments in progress at Cargo Fleet, further large expenditure on new plant is contemplated and the primary object of the tour is to investigate the latest types of cold-rolling mills and finishing plants for the production of wide sheets which are largely used in the motor-car and pressing trades. In America, he said, they can turn out sheets of a width which allows the motor-car manufacturer much greater latitude so far as the style is concerned. They would seek to follow the American practice in turning out a wide sheet of high-class finish capable of giving manufacturers the fullest scope both in the matter of build and final appearance.

Obituary

MR. OLIVER CROMWELL JEFFERSON, aged 68, formerly foundry manager at the works of Taylor & Wadsworth, Leeds, died at Morecambe on September 3.

MR. WALTER BUTTERWORTH, head of Messrs. Butterworth Bros., Limited, glass manufacturers, of Newton Heath, Manchester, died on Sunday, September 1. Mr. Butterworth took a deep interest in the public affairs of Manchester and was for eight years on the City Council. He was for many years chairman of the Council of the Whitworth Institute. The honorary degree of M.A. was conferred on Mr. Butterworth by Manchester University in 1924.

Company Reports

Radiation, Limited.—Interim dividend of 7½d. per share (3¾ per cent. actual).

J. Blakeborough & Sons, Limited.—Profit for year to June 30 last, £31,170 (after depreciation, taxation and trustees' fees); brought in, £1,410; note interest, £5,285; note redemption, £5,420; to property reserve, £5,000; written off patent rights, £762; preference dividend, £5,281; ordinary dividend of 5 per cent., £5,850; carried forward, £4,070.

R. & W. Hawthorn, Leslie & Company, Limited.—Profit for year to June 30 last, £23,194; brought in, £9,948; dividend of 5 per cent. for the year, £17,913; to general reserve, £278; carried forward, £14,951. The debentures of the company were repaid on May 31 last, and the premium of 10 per cent. paid in accordance with the trust deed has been charged against the leasehold sinking fund, which was built up in connection with the debentures. The balance of £44,721 remaining in the fund is proposed to be transferred to the general reserve fund, which, after adding the small appropriation from the profit and loss account, will amount to £425,000. Meeting September 16.

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Raw Material Markets

The demand for iron and steel is well maintained. The majority of new inquiries for pig-iron are for small parcels for early delivery, but deliveries under running contracts are on a good scale. It is expected that consumers' requirements will continue to keep in employment the blast furnaces now working and in all probability one or two more will have to be lighted.

Pig-Iron

MIDDLESBROUGH. — The holiday slackness which has prevailed for the last month or two has now almost completely disappeared. New orders represent in the aggregate fairly good quantities and deliveries have been well maintained. Local foundries are taking up good tonnages of iron, as also are Scottish foundries. Stocks have been reduced to a low level. Export deliveries are still slow, but producers have not completely lost contact in this connection. The fixed minimum scale, which is based on No. 3 Cleveland G.M.B. at 67s. 6d. per ton delivered Middlesbrough, is unaltered.

There has been further activity in hematite buying this week and producers are, in some cases, almost completely sold for six months ahead. Italian shipments are still held up owing to the risks attached to payment, but after special negotiations one cargo of 1,160 tons of hematite has recently been shipped to that country from the Tees. Unchanged prices are as follow :—No. 1 East Coast hematite, 71s. per ton delivered Middlesbrough, 72s. delivered Tyneside, 73s. 6d. delivered North-East Coast and 77s. 6d. delivered Scotland.

LANCASHIRE.—Consumption in this district remains very good, in spite of the holiday period. This week has seen very few new inquiries, but this was to be expected following the heavy buying that has taken place. The heavy electrical branch of the trade is well employed and a large demand for pig-iron is looked for from this source. Staffordshire, Derbyshire and Lancashire brands of No. 3 foundry iron are all quoted for delivery to users in the Lancashire zone on the basis of 74s. per ton, Northamptonshire at 72s. 6d. and Scottish foundry at around 81s. 6d., East Coast hematite at from 80s. to 81s., and West Coast at 81s.

MIDLANDS.—A satisfactory demand for pig-iron has been forthcoming from the ironfounders and an expansion is expected as the year-end approaches. Little new business of note has taken place, but inquiries for small quantities have been circulating. Prices remain unchanged, the minimum figures delivered to Birmingham and Black Country stations being 67s. 6d. per ton for Northants No. 3 and 71s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, these figures being subject to a small sliding-scale rebate to large consumers. Forge pig-iron still has an unimproved demand and the price quoted is 5s. per ton below the corresponding No. 3 foundry level. The general engineering trades provide a satisfactory outlet for special brands of iron, prices being as follow :—Medium phosphorus, 72s. to 82s. 6d.; low phosphorus, 85s. to 90s.; special refined iron, £5 7s. 6d. to £7 per ton delivered. Most hematite users are well covered and as a result little new business has been reported. All prices are now controlled, the minimum figures delivered to this area being 84s. 6d. per ton for West Coast mixed numbers, 83s. for Welsh mixed numbers, 84s. 6d. for East Coast No. 1 and 84s. for East Coast No. 3, including delivery.

SCOTLAND. — This market maintains a steady demand for both common irons and hematite. Small parcels of Scottish foundry iron have been sold, but business in basic and hematite extends into 1936. The official minimum price remains at 70s. f.o.t. furnaces for Scottish No. 3 foundry, with 2s. 6d. extra for No. 1. Light founders continue to be satisfactory purchasers of pig-iron and official quotations for No. 3 Cleveland are unchanged at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow, other English foundry iron being at 1s. 3d. less. Heavy tonnages of both basic and hematite are still being taken up by local steelworks, at the following prices :—Scottish hematite, 71s. to 73s. 6d.; mixed numbers West Coast hematite, 75s.; ordinary mixed numbers East Coast hematite, 77s. 6d.; basic, British and Indian, 70s. (less 5s. rebate), all delivered steelworks.

Coke

After many weeks of waiting consumers have at last commenced buying for the winter. Orders are being booked at current quotations. Durham furnace coke is around 16s. 6d. to 17s. 9d.. and foundry coke 20s. to 21s., at ovens. For delivery to Birmingham and district quotations are as follow :—Best Durham foundry coke, between 37s. 6d. and 40s., with other grades down to 34s. Welsh quotations are between 31s. 6d. and 43s. 6d. per ton, and Scottish low-ash coke in limited quantities may be obtained at about 40s. per ton, delivered Midland stations.

Steel

Signs of the usual autumn improvement in business have become apparent in the steel market, says the official report of the London Iron and Steel Exchange. Although many consumers have covered their requirements until the end of the year, and in some cases into the first quarter of 1936, buying has developed fresh activity, although the demand has been principally confined to small parcels. A substantial volume of business continues to be transacted in semi-finished steel material, and in the absence of offerings of Continental semis orders which have previously gone abroad are being diverted to British works. The makers are being subjected to considerable pressure by consumers to obtain delivery, and in some cases are showing a reluctance to book fresh far-forward contracts. Activity is growing in the finished-steel department and the recent engineering contracts and orders for ships have led to an increased request for many descriptions of steel. The home demand remains the backbone of the industry, but lately there has been a satisfactory expansion in oversea business.

Scrap

A heavy and expanding demand for scrap material is being made by the steelworks in the Cleveland area, and the position generally is very satisfactory. Good heavy melting steel is in particularly good call at 52s. 6d. per ton delivered. Machinery metal is at 54s. per ton and ordinary foundry cast-iron scrap is unchanged at 52s. 6d. per ton delivered works. Light iron has changed hands in small parcels at 42s. 6d. Rather more active conditions prevail on the South Wales market and local steelworks are busy and ready to make larger purchases than have been seen of late. Heavy cast iron in large pieces and furnace sizes is rather erratic at from 51s. to 54s. Light cast-iron scrap is being purchased at 43s. 6d. to 45s., while good cast-iron machinery scrap in foundry sizes sells in small parcels at 52s. 6d. to 55s. per ton. Most qualities of scrap are in steady demand on the Midland market and prices are firm. Cast-iron scrap has a consistent call from the foundries. Heavy machinery metal in handy sizes is at 55s. to 57s. 6d., good heavy at 50s. and clean light at 47s. 6d. Quotations on the Lancashire market are steady. Good machinery cast-iron scrap is at from 47s. 6d. to 55s. per ton, according to grade and the position of supplies, and including delivery to Lancashire foundries.

Metals

Copper. — This market has shown rather an irregular tendency this week. Consumption has been well maintained in this country, but in the United States the demand has fallen off a little, which, however, is hardly surprising having in view the recent heavy buying. A firm undertone still exists in the home market. Stocks in the official warehouses increased last month, but the tonnage is not large enough to have a depressing effect on values.

Daily market prices :—

Cash.—Thursday, £33 3s. 9d. to £33 6s. 3d.; Friday, £33 7s. 6d. to £33 8s. 9d.; Monday, £33 11s. 3d. to £33 13s. 9d.; Tuesday, £33 8s. 9d. to £33 10s.; Wednesday, £33 13s. 9d. to £33 15s.

Three Months.—Thursday, £33 12s. 6d. to £33 13s. 9d.; Friday, £33 16s. 3d. to £33 17s. 6d.; Monday, £34 to £34 1s. 3d.; Tuesday, £33 16s. 3d. to £33 17s. 6d.; Wednesday, £34 2s. 6d. to £34 3s. 9d.

Tin.—This market presents few features of note. An unsettling factor is the meeting of the International Tin Committee, which is in conference over the question of fourth-quarter quotas.

Messrs Rudolf Wolff & Company state :—"Demand on the part of consumers in this country continues to be moderate, fairly active conditions being maintained in the tinplate industry; on the Continent a rather quieter tone has developed, and in the U.S.A. some irregularity is reported, demand from time to time being moderately good. The easier tendency on the London market reflects to some degree the disturbed political situation on the Continent, as also the uncertainty which still surrounds industrial conditions in America. Moreover, the market is in a sensitive condition and price movements are disproportionate to the influences which occasion them, for, in the artificial circumstances which still govern the situation, confidence is slow to return."

Day-to-day fluctuations :—

Cash.—Thursday, £220 to £220 5s.; Friday, £220 15s. to £221; Monday, £219 10s. to £219 15s.; Tuesday, £218 5s. to £218 15s.; Wednesday, £219 to £219 5s.

Three Months.—Thursday, £208 5s. to £208 10s.; Friday, £209 to £209 5s.; Monday, £209 5s. to £219 15s.; Tuesday, £208 to £208 5s.; Wednesday, £209 to £209 5s.

Spelter.—In common with the other base metals spelter has been rather irregular this week. World production of spelter in July amounted to 118,899 short tons, compared with 118,664 tons in June.

Official quotations were as follow :—

Ordinary.—Thursday, £15; Friday, £15 2s. 6d.; Monday, £15 3s. 9d.; Tuesday, £15 2s. 6d.; Wednesday, £15 2s. 6d.

Lead.—The position of this metal is sound and consumption remains at a high level. The production of lead in July, as estimated by the American Bureau of Metal Statistics, was 128,637 short tons, as compared with 120,830 tons in the previous month.

Day-to-day quotations :—

Soft Foreign (Prompt).—Thursday, £15 11s. 3d.; Friday, £15 12s. 6d.; Monday, £15 13s. 9d.; Tuesday, £15 11s. 3d.; Wednesday, £15 13s. 9d.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

431,977. SCIAKY, D. Electric spot-welding installations.

431,985. IGRANIC ELECTRIC COMPANY, LIMITED. Electric welding system.

431,986. OSTENDORF, P., and EISNER, P. Method of plating metal sheets or plates of iron or other metal.

432,047. ESSER, H. Pilger rolls.

432,212. RODRIGUEZ, A. O. Method of coating ferrous bodies with other metals.

432,213. SCOTT, W. Refractory linings for rotary-melting furnaces

432,262. AMERICAN METAL COMPANY, LIMITED. Stools to support moulds for casting metal.

432,439. SOC. D'ELECTRO-CHIMIE, D'ELECTRO-METALLURGIE, ET DES ACIERIES ELECTRIQUES D'UGINE. Process for purifying nickel.

432,454. PIPE LININGS (AUSTRALASIA), LIMITED. Process and apparatus for lining metal pipes with bitumen or bituminous compositions.

432,465. METALLGES. AKT.-GES. Method of operating rotary-drum furnaces.

432,476. METALLGES. AKT.-GES. Rotary-drum furnace.

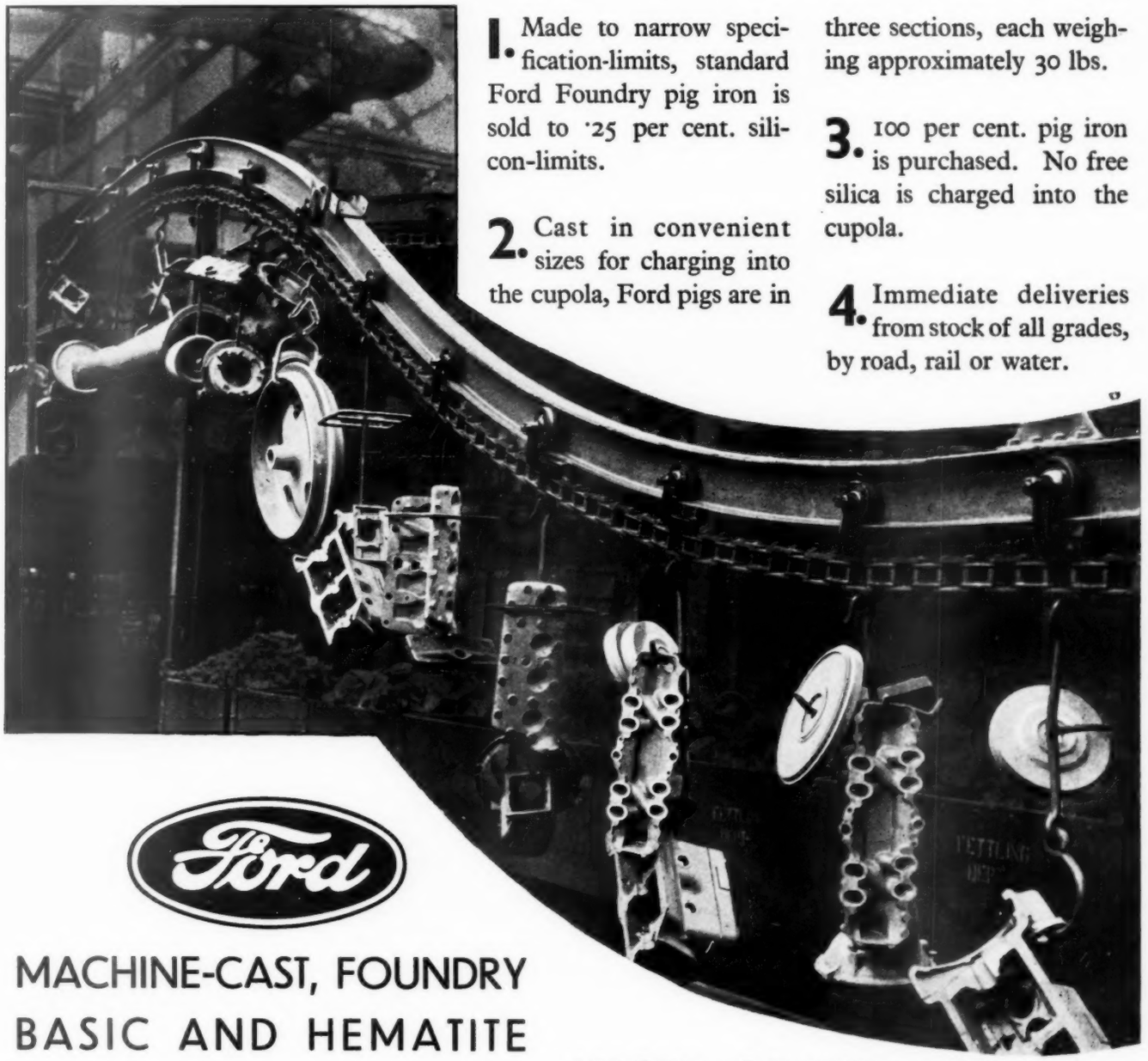
432,497. DELOT, M. H. V., and PIGAL, R. A. Smelting furnaces.

432,512. STERLING METALS, LIMITED, and GASCOIGNE, D. J. Refractory linings for furnaces, and bricks therefor.

432,530. BRITISH THOMSON-HOUSTON COMPANY, LIMITED. Methods of reconditioning worn rails.

432,548. UNITED STATES STEEL CORPORATION. Method of heat-treating chromium-containing corrosion and/or heat-resisting steels.

Advantages of FORD Machine-Cast PIG IRON



1. Made to narrow specification-limits, standard Ford Foundry pig iron is sold to ·25 per cent. silicon-limits.

2. Cast in convenient sizes for charging into the cupola, Ford pigs are in three sections, each weighing approximately 30 lbs.

3. 100 per cent. pig iron is purchased. No free silica is charged into the cupola.

4. Immediate deliveries from stock of all grades, by road, rail or water.

Ford

MACHINE-CAST, FOUNDRY BASIC AND HEMATITE

PIG IRONS,

Manufactured By

FORD MOTOR COMPANY LIMITED, DAGENHAM, ESSEX

★

VISIT STAND NO. 16, ROW D,

(Telephone: Shepherd's Bush 2802)

FOUNDRY TRADE EXHIBITION, OLYMPIA,

September 12-28, 1935.

RAW MATERIALS—PRICE LIST

(Wednesday, September 11, 1935)

COPPER

	£ s. d.
Standard cash	33 13 9
Three months	34 2 6
Electrolytic	37 5 0
Tough	35 10 0
Best selected	36 0 0
Sheets	64 0 0
India	47 10 0
Wire bars	37 10 0
Ingot bars	37 2 6
H.C. wire rods	41 0 0
Off. av. cash, August	32 13 6½
Do., 3 mths., August	33 1 0½
Do., Sttlmnt., August	32 13 5½
Do., Electro, August	36 5 0
Do., B.S., August	35 10 10
Do., wire bars, August	36 10 5½
Solid drawn tubes	10d.
Brazed tubes	10d.
Wire	6d.

BRASS

Solid drawn tubes	9¼d.
Brazed tubes	11¼d.
Rods, drawn	8d.
Rods, extd. or rlld.	4¼d.
Sheets to 10 w.g.	7¼d.
Wire	7¼d.
Rolled metal	7¼d.
Yellow metal rods	4¼d.
Do. 4 × 4 Squares	5¼d.
Do. 4 × 3 Sheets	5¼d.

TIN

	£ s. d.
Standard cash	219 0 0
Three months	209 0 0
English	219 5 0
Bars	220 5 0
Straits (nom.)	219 10 0
Australian (nom.)	219 10 0
Eastern	217 0 0
Banca (nom.)	221 0 0
Off. av. cash, August	223 4 8⅜
Do., 3 mths., August	212 19 8⅞
Do., Sttlmt., August	223 4 3⅞

SPELTER

	£ s. d.
Ordinary	15 2 6
Remelted	15 15 0
Hard	12 10 0
Electro 99.9	17 15 0
English	16 0 0
India	13 5 0
Zinc dust	19 10 0
Zinc ashes	3 5 0
Off. aver., August	14 16 6 3/16
Aver. spot, August	14 14 3⅜

LEAD

	£ s. d.
Soft foreign ppt.	15 13 9
Empire (nom.)	16 3 9
English	17 10 0
Off. average, August	15 15 7⅜
Average spot, August	15 15 5⅝

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	23 10 0
Do., V.M. ex-whse.	24 5 0
Rods	29 0 0

ANTIMONY

	£ s. d.
English	74 0 0 to 75 0 0
Chinese, ex-whse.	67 0 0
Crude, c.i.f.	28 10 0

QUICKSILVER

	£ s. d.
Quicksilver	11 0 0 to 11 10 0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	12 15 0
75%	17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£17 0 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	33 0 0
4/6% car.	21 15 0
6/8% car.	21 0 0
8/10% car.	21 0 0
Ferro-chrome—	
Max. 2% car.	34 0 0
Max. 1% car.	36 5 0
Max. 0.70% car.	37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/6 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to 11 5 0
76/80% packed	£11 15 0 to 12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales—	£ s. d.	£ s. d.
Heavy steel		2 16 0
Bundled shrngs.	2 7 6	to 2 16 0
Mixed iron and steel	2 10 0	to 2 12 0
Heavy cast iron	2 11 0	to 2 14 0
Good machinery	2 12 6	to 2 15 0
Cleveland—		
Heavy steel		2 12 6
Steel turnings		1 17 6
Cast-iron borings		1 7 6
Heavy cast iron		2 12 6
Heavy machinery		2 15 0
Midlands—		
Light cast-iron scrap		2 7 6
Heavy wrought iron		2 17 6
Steel turnings		1 14 0
Scotland—		
Heavy steel		2 10 0
Ordinary cast iron		2 12 6
Engineers' turnings		1 19 6
Cast-iron borings	1 17 6	to 1 19 0
Wrot-iron piling		2 17 6
Heavy machinery		2 16 6

London—Merchants' buying prices, delivered yard.

	£ s. d.
Copper (clean)	27 0 0
Brass	18 0 0
Lead (less usual draft)	13 10 0
Tea lead	10 0 0
Zinc	9 10 0
New aluminium cuttings	69 0 0
Braziery copper	23 0 0
Gunmetal	25 0 0
Hollow pewter	150 0 0
Shaped black pewter	116 0 0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	71/-
Hematite M/Nos.	70/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	75/-
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d/d	71/- to 73/6
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
W.C. hematite	86/-
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell. No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	81/6
Clyde, No. 3	81/6
Monkland, No. 3	81/6
Summerlee, No. 3	81/6
Eglinton, No. 3	81/6
Gartsherrie, No. 3	81/6
Shotts, No. 3	81/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	9 12 6	to 9 15 0
Nut and bolt iron	7 10 0	to 8 0 0
Hoops	10 10 0	and up.
Marked bars (Staffs) f.o.t.	12 0 0	
Gas strip	10 10 0	and up.
Bolts and nuts, ¾ in. × 4 in.	14 2 6	and up.
Steel—		
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	9 5 0	to 9 7 6
Chequer plts.	10 7 6	
Angles	8 7 6	
Tees	9 7 6	
Joists	8 15 0	
Rounds and squares, 3 in. to 5½ in.	9 7 6	
Rounds under 3 in. to ¾ in. (Untested)	8 12 0	
Flats—8 in. wide and over	8 12 6	
,, under 8 in. and over 5 in.	8 17 6	
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 5 0	to 12 10 0
Hoops (Staffs)	9 7 0	
Black sheets, 24g. (4-t. lots)	11 0 0	
Galv. cor. shts. (,,)	13 0 0	
Galv. flat shts. (,,)	13 10 0	
Galv. fencing wire, 8g. plain	14 10 0	
Billets, soft	5 10 0	and up.
Billets, hard	6 17 6	to 7 2 6
Sheet bars	5 5 0	to 5 10 0
Tin bars	5 5 0	to 5 10 0

PHOSPHOR BRONZE

	Per lb. basis.
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12d.
Rods	11d.
Tubes	13½d.
Castings	12d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.31
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Malleable, Valley	18.50
Grey forge, Valley	18.00
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.85
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.40
Plain wire	2.30
Barbed wire, galv.	2.80
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 21/-
Durham foundry	20/- to 21/-
,, furnace	16/6 to 17/9
Scotland, foundry	28/-
,, furnace	25/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/2 and up.
,,	28×20 ,,	36/4 and up.
,,	20×10 ,,	26/- to 26/3
,,	18¾×14 ,,	18/9 to 19/-
C.W.	20×14 ,,	15/6
,,	28×20 ,,	32/6
,,	20×10 ,,	22/9
,,	18¾×14 ,,	15/6

SWEDISH CHARCOAL IRON & STEEL

	£ s. d.	£ s. d.
Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.		
Sept. 5 ..	33	3	9	inc.	7/6
„ 6 ..	33	7	6	„	3/9
„ 9 ..	33	11	3	„	3/9
„ 10 ..	33	8	9	dec.	2/6
„ 11 ..	33	13	9	inc.	5/–

Electrolytic Copper

	£	s.	d.		
Sept. 5 ..	36	15	0	No	change
„ 6 ..	37	0	0	inc.	5/–
„ 9 ..	37	5	0	„	5/–
„ 10 ..	37	0	0	dec.	5/–
„ 11 ..	37	5	0	inc.	5/–

Standard Tin (cash)

	£	s.	d.		
Sept. 5 ..	220	0	0	inc.	10/–
„ 6 ..	220	15	0	„	15/–
„ 9 ..	219	10	0	dec.	25/–
„ 10 ..	218	5	0	„	25/–
„ 11 ..	219	0	0	inc.	15/–

Tin (English ingots)

	£	s.	d.		
Sept. 5 ..	220	0	0	inc.	5/–
„ 6 ..	221	0	0	„	20/–
„ 9 ..	219	10	0	dec.	30/–
„ 10 ..	218	10	0	„	20/–
„ 11 ..	219	5	0	inc.	15/–

Spelter (ordinary)

	£	s.	d.		
Sept. 5 ..	15	0	0	inc.	1/3
„ 6 ..	15	2	6	„	2/6
„ 9 ..	15	3	9	„	1/3
„ 10 ..	15	2	6	dec.	1/3
„ 11 ..	15	2	6	No	change

Spelter (Electro, 99.9 per cent.)

	£	s.	d.		
Sept. 5 ..	17	12	6	No	change
„ 6 ..	17	15	0	inc.	2/6
„ 9 ..	17	17	6	„	2/6
„ 10 ..	17	15	0	dec.	2/6
„ 11 ..	17	15	0	No	change

Zinc Sheets (English)

	£	s.	d.		
Sept. 5 ..	23	5	0	inc.	5/–
„ 6 ..	23	7	6	„	2/6
„ 9 ..	23	10	0	„	2/6
„ 10 ..	23	10	0	No	change
„ 11 ..	23	10	0	„	„

Lead (English)

	£	s.	d.		
Sept. 5 ..	17	10	0	No	change
„ 6 ..	17	10	0	„	„
„ 9 ..	17	10	0	„	„
„ 10 ..	17	10	0	„	„
„ 11 ..	17	10	0	„	„

AVERAGE MONTHLY PRICES OF STEEL BOILER PLATES IN ENGLAND

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1898	6 10 0	6 8 9	6 8 9	6 10 0	6 15 0	6 18 9	6 17 6	6 17 6	7 2 6	6 15 0	7 0 0	7 5 0	6 15 8½
1899	7 5 0	8 0 0	8 2 6	8 2 6	8 5 0	8 5 0	8 12 6	8 12 6	8 15 0	8 15 0	9 2 6	9 5 0	8 17 8½
1900	9 5 0	9 5 0	9 7 6	9 10 0	9 12 6	10 5 0	10 5 0	10 5 0	10 5 0	10 0 0	9 15 0	9 15 0	9 15 10
1901	9 5 0	9 5 0	8 15 0	8 10 0	8 10 0	7 10 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 3 11
1902	7 7 6	7 0 0	7 12 6	7 12 6	7 12 6	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 9 7
1903	7 10 0	7 10 0	7 15 0	7 5 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	6 17 6	7 3 11½
1904	6 12 6	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 11½
1905	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 10 0	7 5 0	8 0 0	8 0 0	7 1 5
1906	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 0 10
1907	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 8 4
1908	7 10 0	7 10 0	7 10 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 3 9
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 15 0	6 15 0	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 9
1910	7 0 0	7 0 0	7 1 3	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 10 0	7 10 0	7 10 0	7 5 1
1911	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 14 0	7 10 4
1912	7 18 9	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 15 0	8 16 3	9 0 0	9 2 0	9 5 0	8 11 2½
1913	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	8 19 0	8 15 0	8 5 0	7 15 0	7 15 0	8 17 0
1914	7 15 0	7 15 0	7 15 0	7 13 9	7 10 6	7 5 0	7 0 0	8 0 0	8 2 6	8 5 0	8 5 0	8 5 0	7 15 11½
1915	8 14 0	9 10 0	9 17 6	10 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 4 0	12 0 0	13 0 0	10 15 5½
1916	13 0 0	13 0 0	13 0 0	12 15 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 12 11
1917	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1918	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1919	13 0 0	15 0 0	15 0 0	15 0 0	19 5 0	19 17 6	21 0 0	21 10 0	21 10 0	21 10 0	21 15 0	23 10 0	18 9 9
1920	26 0 0	28 0 0	28 5 0	28 10 0	29 5 0	30 0 0	30 0 0	30 0 0	30 10 0	31 0 0	31 0 0	31 0 0	29 9 2
1921	30 5 0	29 0 0	25 0 0	25 0 0	25 0 0	23 0 0	21 0 0	20 10 0	19 0 0	17 10 0	16 0 0	14 16 0	22 1 9
1922	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 1 8	13 10 0	12 15 0	12 10 0	12 10 0	12 10 0	12 6 0	13 10 9
1923	12 8 9	13 6 0	14 0 0	14 0 0	14 0 0	14 0 0	13 12 6	13 0 0	13 0 0	13 0 0	13 0 0	13 10 0	13 9 1½
1924	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	14 0 0	14 0 0	13 11 0	13 5 0	13 5 0	13 10 11
1925	13 5 0	13 5 0	13 5 0	13 1 0	12 15 0	12 15 0	12 15 0	12 15 0	12 7 6	11 14 0	11 10 0	11 10 0	12 11 5½
1926	11 10 0	11 10 0	11 10 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 6 3
1927	11 5 0	11 5 0	11 5 0	11 5 0	11 2 6	11 0 0	11 0 0	11 0 0	10 16 0	10 10 0	10 10 0	10 10 0	10 19 0½
1928	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0
1929	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 5 0	10 1 3	10 1 3	10 1 3	10 1 7	10 6 8½
1930	10 2 9	10 3 5½	10 3 9	10 3 9	10 3 6	10 2 6	10 2 6	10 2 6	10 2 2½	9 19 6	9 16 3	9 16 3	10 1 6½
1931	9 15 0	9 15 0	9 15 0	9 10 11	9 6 9	9 5 0	9 7 0	9 7 9½	9 8 9	9 5 9	9 5 6	9 9 6	9 9 4
1932	9 5 0	9 2 6	8 18 6	8 17 6	8 16 6½	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 16 3	8 17 10
1933	8 10 0	8 10 0	8 10 0	8 8 9	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 6 0	8 7 6	8 6 10½
1934	8 8 1½	8 10 7½	8 16 6	8 17 6	8 6 3	8 6 3	8 5 7½	8 5 0	8 5 0	8 5 0	9 6 3	9 6 3	8 11 6½
1935	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	9 6 3	—	—	—	—	—

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